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ABSTRACT

This document reports the results of a workshop held to assess the impact of federal programs and legislation on manpower planning for scientists and engineers. Included are presentations relating to manpower utilization and planning via federal government agencies and professional societies for scientists and engineers. It was concluded that the governmental impact is substantial and permanent; better approaches, tools, and policies are needed to insure that government actions do not become overbearing nor counterproductive. (SL)

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THE IMPACT OF FEDERAL PROGRAMS AND POLICIES

ON

MANPOWER PLANNING for SCIENTISTS & ENGINEERS

REPORT OF A WORKSHOP

SMC

SCIENTIFIC MANPOWER COMMISSION

SE 023 133

THE IMPACT OF FEDERAL PROGRAMS AND POLICIES

ON

MANPOWER PLANNING FOR SCIENTISTS AND ENGINEERS

PROBLEMS AND PROGRESS

* * * * * * * *

REPORT OF A WORKSHOP

CONDUCTED BY

SCIENTIFIC MANPOWER COMMISSION

and

MANPOWER ANALYSIS AND PLANNING SOCIETY OF WASHINGTON, D. C.

With Support from the

NATIONAL SCIENCE FOUNDATION

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MARCH 31 - APRIL 1, 1977

STOUFFER'S NATIONAL CENTER HOTEL
2399 Jefferson Davis Highway
Arlington, Virginia 22202

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THE SCIENTIFIC MANPOWER COMMISSION

The Scientific Manpower Commission is a nonprofit corporation made up of Commissioners representing its eleven member scientific societies.

The Commission is charged with the collection, analysis and dissemination of reliable information pertaining to the manpower resources of the United States in the fields of science, engineering and technology; promotion of the best possible programs of education and training of potential scientists, engineers and technicians; and development of policies of utilization of scientific, engineering and technological manpower by educational institutions, industry and government for optimum benefit to the nation.

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American Astronomical Society
American Chemical Society
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Conference Board of the Mathematical Sciences
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THE MANPOWER ANALYSIS AND PLANNING SOCIETY OF WASHINGTON, D. C.

The Manpower Analysis and Planning Society is an organization of manpower professionals devoted to the advancement of concepts, methods and systems for the generation of demand/supply assessments and other analytic information that will facilitate decision-making (at national, regional and organizational levels) concerning policies and programs for the development and utilization of human resources.

Founded in 1966, MAP's purposes include: improving the art and expanding the application of Manpower Analysis and Planning; fostering an interchange of ideas and information among its members; advocating and presenting positions to public and private organizations on manpower issues; increasing the skills of manpower practitioners through the development and promotion of educational activities; and promoting high ethical and professional standards for manpower practitioners.

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TABLE OF CONTENTS

INTRODUCTION 1

FORMAT OF THE WORKSHOP 3

SUMMARY, RECOMMENDATIONS AND CONCLUSIONS - *Philip Nowers* . . . 4

SPEAKER SUMMARIES . . . . . .

PANEL I

Introduction - *Michael Crowley* 8
Manpower Planning at the Environmental Protection Agency - *J. Donald Cook* 9
Manpower Assessment - The Recent ERDA Experience - *Norman Seltzer* 9
Manpower Planning in the Bureau of Health Manpower - *Howard Stambler* 11
Manpower Planning for the Texas Water Quality Board - *Tom Jackson* 13
Manpower Planning in Industry - *Herman Finkbeiner* 15
Manpower Planning in the Private Sector - *James Walker* . . 16

PANEL II

Introduction - *Richard Wilcox* 18
The Role of Universities in Manpower Planning - *Bernard Khoury* . 20
Minority Women Employment Program - *Howard Rosen* 24
Federal Policy Implications on Manpower Development for Health Care in Pennsylvania - *Deanna Mechensky* 26
National Science Foundation Science and Engineering Manpower Data - *James Brown* 27
Data Resources from the Bureau of Labor Statistics - *Neal Rosenthal* 29
Projections of Earned Degrees Conferred - *Martin Frankel* . . 31
Discrimination - An Evolving Definition - *Peter Robertson* . . 33

PANEL III

Introduction - *Betty Vetter* 35
Power, Prestige and Honor: A Dream for Girls, Too - *Mary Ellen Verheyden-Hilliard* 36
The Impact of the American Chemical Society on Employment Concerns of Scientists and Engineers - *Robert Neuman* 38
Activities and Concerns of Professional Societies in Physics - *Beverly Porter* 41
Employment Concerns of Scientists and Engineers - *Frank Collins* . 43
Public Interest Considerations for Manpower Planning in Science - *Nancy Abrams* 45

APPENDIX I - Evaluation of the Workshop 48
- SMC/MAPS Workshop Planning Committee 48

APPENDIX II - Workshop Participants 50

APPENDIX III - Glossary of Acronyms 55

THE IMPACT OF FEDERAL PROGRAMS AND POLICIES ON MANPOWER PLANNING FOR SCIENTISTS AND ENGINEERS, PROBLEMS AND PROGRESS

A workshop conducted by Scientific Manpower Commission and Manpower Analysis and Planning Society of Washington, D. C., on March 31 and April 1, 1977 in Arlington, Virginia

INTRODUCTION

Recognizing the need to examine the manpower implications of proliferating federal legislation and its resulting regulations; and concerned with the increased expectations of women and minorities in a period of slowed economic growth, the Scientific Manpower Commission and the Manpower Analysis and Planning Society of Washington, D. C. conducted a workshop to examine the impact of federal programs and policies on manpower planning for scientists and engineers.

Some of the workshop objectives were summarized in the opening remarks.

"We are gradually learning that the availability of trained and motivated workers, gainfully and productively employed during an appropriate segment of their lives, depends upon a variety of factors. These factors, in turn, are influenced by increasingly pervasive programs and policies of the federal government. Seldom are these programs and policies viewed in their relationships as individual agencies pursue individual objectives. It is imperative that those involved in analysis and planning of manpower develop this broader picture and seek such means as this workshop to bring it into focus.

"We do not just concern ourselves with actuarial counting of positions available and positions sought. The government provides stimulus for new curricula, for curricular content, for predoctoral funds, for postdoctoral funds, and even for career or modified life grants. As these stimuli relate to certain disciplines and not to all, as they ebb and flow under the pressures upon Congress, as they reflect the disciplinary background or interests of program managers, just so they impact upon the next generation in too frequent over-supply, under-employment and welfare.

"Further, there is a notable, even alarming, increase in government edicts and directives now prescribing how one trained in science and/or engineering performs his job. Individuals with no designated training or qualifications can determine whether an industry is complying with certain regulations, whether a laboratory meets requirements or whether a fee for an unusual situation must conform to one estiblished for the routine. The impact of the superabundance of regulating agencies upon the challenge and attractiveness of the world of the professional must be recognized and countered.

"We must admit that the present largely intuitive approaches have not done so well. This workshop should be but one to explore the full range from education, training support, retraining and continuing education efforts, minimum wages, criteria for welfare,

government wages, certification and licensing which, wittingly or unwittingly, contribute to our concern about manpower and inhibit our capability in manpower planning."

Dr. Richard Trumbull, President
Scientific Manpower Commission

"The degree to which the objectives of a national program are achieved is primarily dependent upon ... the human resources available to carry it out. ... Conversely, the personal well being of each individual in the workforce is primarily dependent upon his knowing that his abilities are properly used and that he has opportunities for further growth.

"Manpower planning technology can contribute to ensuring that ... these humans resources are productively used."

Morton Ettelstein, President
Manpower Analysis and Planning Society

All segments of society are affected by and must confront these issues. Some government agencies are responsible for implementing national legislation. Others are charged with collecting and analyzing the data required for adequate planning and implementation.

Educational institutions, which both train and employ scientists and engineers, are often assisted and sometimes hobbled by government programs and policies. Employers, both public and private, must adjust to changes required by government regulations as they plan and carry out their responsibilities to students, employees and stockholders. Finally, individual scientists and engineers and a concerned public have a stake in manpower planning as it attempts to insure adequate supplies of trained scientists and engineers and means for utilizing those who are trained - all within the context of other national interest.

This workshop attempted to explore the complex relationships among these diverse interests, seeking for a better understanding of the most effective ways to serve the needs of all segments of our technological society through better manpower planning.

Ninety six participants, including twenty five panelists carried out a stimulating dialogue that mixed information exchange with some differences of opinion, and achieved at the minumun a concentrated period of interaction among persons concerned with scientific and engineering manpower in government, industry, academe and the professional societies. The workshop did not provide any magical solutions to complex problems. It did provide a forum for mutual discussion, and the exchange of information and ideas.

FORMAT OF THE WORKSHOP

Both federal activities and federal rules and regulations impact variously on different kinds of organizations and on individual scientists and engineers. Three workshop panels attempted to deal with this diversity in an interrelated manner.

- Panel I included representatives of three federal agencies responsible for carrying out specific legislative mandates, such as developing alternative sources of energy, protecting the environment, and insuring adequate health care. Each of these organizations is concerned with the development and utilization of scientists and engineers as this affects their ability to carry out their legislative mandate.

The federal government impacts on both state and local government agencies charged with similar project-oriented functions; and with the private sector which is both regulated by and contributory to federally legislated objectives, and adjusts its operations accordingly.

- Panel II included representatives of federal support agencies having manpower employment, utilization, regulation and education responsibilities. The National Science Foundation, the U.S. Department of Labor's Bureau of Labor Statistics and the National Center for Education Statistics are charged with collecting and analyzing statistical information on manpower resources in science and engineering, to provide the basis for national planning and policy formulation.

Manpower and training agencies at the state level represented by one such agency in Pennsylvania, and a pilot program operated by a federal agency at the local level indicated some of the great diversity of government impact on individuals.

The several federal regulatory agencies were represented by the Equal Employment Opportunity Commission examining the effect of affirmative action legislation on manpower planning.

Colleges and universities, as both producers and employers of scientists and engineers, are linked with these government agencies at every stage.

- Panel III considered the impact of federal programs and policies on individual scientists and engineers. The counseling process, particularly as it influences young women, and the effect of public interest in and public understanding of science and engineering on the recruitment, education and utilization of scientists and engineers were viewed as a prelude to the manpower activities of professional societies and unions who act as representatives for scientists and engineers. Specific concerns were:

SUMMARY, RECOMMENDATIONS AND CONCLUSIONS

Philip P. Nowers
Program Manager
Waste Equipment Manufactures Institute

Summarizing a workshop such as this one is always difficult and the results rarely satisfactory. In part this is the result of a format that puts a wide variety of ideas, data, and opinions before an audience in a compressed period of time. In part it is related to the many uses and shades of meaning ascribed to the word "manpower" by those who deal with the complex phenomenon of human resource study and management.

In spite of these inherent problems there were recurring themes in the presentations which can be summarized. Given the situation in the manpower field and the format of the program this is all the more remarkable.

The first part of this summary will enumerate, in general terms, those themes that most of the speakers touched upon in their presentations. While the terminology may differ from that preferred by the speakers, the ideas and concerns constituted a significant part of their presentations. Second, brief references to the specific talks indicate how they relate to the ideas presented here. This section is cursory because the reader may refer to the more complete summaries in the volume. Finally, some conclusions and recommendations that flowed reasonably from this review of the workshop are presented. This section in no way reflects a consensus of those attending or participating in the workshop.

Interoccupational Mobility

If we look at our own careers and those of our associates we cannot help but be struck by the extraordinary amount of flexibility which our human resource system not only allows but demands. A recent Labor Department study cited in the Wall Street Journal (2/8/77) found that only 47% of men and 40% of women with jobs in 1965 had the same occupation in 1970. That is, in addition to changes in jobs, close to half the labor force actually entered different occupations over a five year period.

The implications of such a finding, which experience corroborates, are enormous for manpower planners and analysts. For one thing it suggests that any model based on fixed occupational or educational attributes is wholly inappropriate for conditions in the United States, at least as far as the overall labor force is concerned. An exception to this rule might be where rigid licensing or certification requirements place legal limits on entry to particular fields. Law and medicine are examples of this case, and to a lesser degree, some areas of science and engineering.

Adequacy of Conceptual and Empirical Tools

Directly related to the high mobility of the labor force is the fact that, in most cases, attempts to count or project the available supply of labor will eventually be confounded by the dynamic forces that continually reshape it as demand changes. This means, by definition, that the labor market is adjusting or attempting to adjust supply and demand. It also means that planning approaches designed for or assuming essential stability in the relevant labor force will face considerable frustration.

Some approaches are, however, relatively well adapted to these conditions and it is important to identify and support these efforts. While it would be unwise to simply abandon traditional measures and definitions, it is equally unwise not to try to move beyond them into areas that suggest greater promise for the future.

Sex and Race in the Labor Force

The nation has embraced a policy of increasing, both quantitatively and qualitatively, the labor force participation and utilization at all levels of women and racial minorities.

This policy has broad appeal and political support. It also produces anger and fear among some individuals at all levels of responsibility. Changes are occurring both voluntarily and under federal enforcement programs of various types, and these changes are seen as too slow by some and too rapid by others.

One immediate impact of this policy has been to bring the manpower planning into the board room and the court room to help formulate practical programs that will lead to the upgrading of women and minorities in the job market without unnecessary waste or disruption. It is a challenging role and one that demands a degree of vigor, perception and dedication seldom required in the past. Yet, it is a role that should not be evaded, because in the absence of adequate data, sensitive guidance and realistic expectations we are likely to end up with having spent heavily and accomplished little.

Scope of the Presentation

Three federal government agency representatives (Environmental Protection Agency, Energy Research and Development Administration, Health Resources Administration) discussed their experiences with manpower planning. While each had widely varying kinds of experience and resources with which to probe the subject, each expressed a feeling that basic and important issues had managed to elude them. One speaker noted that new approaches to manpower analysis were needed due to an absence of a fixed technology in new fields of endeavor. Another suggested that more attention should be paid to analyzing data from small samples rather than attempting to inventory stocks of skilled workers.

Two representatives of the private sector discussed affirmative action in employment programs and some of the consequences of current policies. The challenge of changing technology (factor relationships) was presented with some new analytical approaches appropriate at the micro level. The inadequacy of traditional occupational or disciplinary groupings was highlighted.

Two speakers presented state-level problems (Texas, Pennsylvania). At this level all of the difficulties encountered on the federal level exist and are further compounded by significant geographic mobility and extremely modest financial resources. Better approaches apparently are needed.

Reports from three federal government agencies that study the labor market (National Center for Education Statistics, Department of Labor's Educational Training Administration and its Bureau of Labor Statistics, National Science Foundation) indicate that while much of what they do is of necessity traditional, there are new ideas being developed and demonstrated that show promise of being more attuned to the requirements of manpower decision-making.

A representative of the higher education community pointed out the limits of using universities as vehicles for federal manpower management. Rapid shifts in federal policy were seen as disruptive and unnecessary, while the continued linkage between higher education and the federal government is inevitable.

An EEOC representative discussed the legal and philosophical basis of "affirmative action" in the labor market. Two other speakers highlighted the special problems of women in scientific and engineering fields, providing reminders of the continuing need for better and more available data and for renunciation in every area of the damaging myths that have kept women out of participation in the scientific enterprise.

Two speakers from professional societies discussed the tenuous relationship between professional education and jobs and how this affects their roles and services. A professional union representative noted that no one today can expect the luxury of a lifetime job and discussed the need for aids to versatility in the workplace.

Recommendations

1. By whatever name it is called, the all-important factor of high inter-occupational mobility resulting in part from continually changing productive relationships and in part from highly adaptable workers needs to be moved into the analytical spotlight by manpower professionals. There has been an historical tendency to assume this factor away for the sake of conceptual models which seemed reasonable and offered the promise of an early payoff. Unfortunately, the models become virtually useless for projecting the future because of this element.

2. New empirical approaches are needed that emphasize tasks rather than occupational titles, programs rather than educational histories. Some elements of the NSF Manpower Characteristics System take this approach and these should be recognized and used. One speaker noted the need for activity analysis in industry in recognition of the fact that nearly everyone "makes their own job."

There are challenges in developing adequate tools to meet this need. To become too theoretical is to risk putting oneself into the position that any measurement at all is impossible. On the other hand, labor is allocated in the United States by a market, albeit an imperfect one, and every attempt should be made to incorporate this fact into empirical work rather than assuming it away.

3. The full integration of women and minorities into the American labor market and specifically into science and engineering can be done only with the active cooperation of the manpower community. Costly errors and miscalculations can be avoided by timely and well-executed studies made on the basis of existing and new data and on changing time-worn assumptions which no longer apply. To think that such an ambitious and deep change can occur efficiently on the basis of legal action alone is unrealistic.

Conclusion

The intent of this workshop was to concentrate on the impact of federal regulations and activities on the supply and utilization of scientists and engineers. Federal involvement in the scientific and engineering labor market is substantial and virtually permanent. The federal government has spent both

money and effort on monitoring and influencing the numbers and the utilization of technically skilled Americans.

The number of speakers and their broad interests attest to the degree to which the government's influence is present in the scientific and engineering labor market. A basic message of the workshop was that the skills of the manpower analyst can and should be used to insure that government actions become neither overbearing nor counterproductive. Manpower professionals can probably best realize that goal by developing better approaches, tools, and policy alternatives so that our most important resources, the human ones, are not misused.

PANEL I

ACTIVITIES AND CONCERNS OF ORGANIZATIONS WITH DIRECT RESPONSIBILITIES FOR IMPLEMENTING NATIONAL LEGISLATION

Specific concerns addressed by this panel were:

- *The importance of manpower factors in the attainment of legislated objectives.*
- *Methodologies and systems for determining manpower and training needs relative to supply.*
- *Relationships with others in designing education and training programs to meet needs, especially as they pertain to increasing the participation of women and minorities.*
- *Considerations imposed by affirmative action legislation.*

INTRODUCTION - PANEL I

Michael F. Crowley
Staff Associate, Manpower Section
Division of Science Resources Studies
National Science Foundation

In 1975, the Labor Department published the results of a study funded by the National Science Foundation which stated that:

> "The repercussions of government action and policies are far reaching and exceedingly complex. Many federal programs are developed without any consideration or assessment of the consequences of their operation on the manpower resources of the country and while such an assessment perhaps would not solve any conflicts in values or in priorities inherent in the operation of different programs, it would assist in the decision-making process."*

Have things changed since that report was issued? Do Government agencies and private organizations assess the manpower implication of national legislation and Federal policies?

Our first panel centers around the activities and concerns of organizations - public and private - with direct responsibilities for implementing national legislation. By "direct responsibilities for implementing national legislation" we mean those Government agencies responsible for carrying out specific mandates such as developing alternative sources of energy, protecting the environment, insuring adequate health care, and requiring equal opportunity for employment. In carrying out their legislative mandates, the Federal agencies impact on state and local governments and on the private sector since the federal government frequently uses private firms, nonprofit institutions, and state and local governments as the principal channels for carrying out required activities, or because the legislation, such as requirements for clean air and affirmative action, may directly affect a firm or agency's methods of operation.

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* Impact of Federal Pollution Control and Abatement Expenditures on Manpower Requirements, Bulletin 1836, U.S. Department of Labor, Bureau of Labor Statistics, 1975.

CURRENT STATUS OF MANPOWER PLANNING AT THE ENVIRONMENTAL PROTECTION AGENCY

J. Donald Cook
Acting Director of Education
Manpower and Training Staff
Environmental Protection Agency

The Environmental Protection Agency employs a high proportion of mid-level scientists and engineers - about 60% of total EPA employment of 10,000. In direct pollution control, 700,000 persons are working nationwide including those in state and local governments. Skill needs are critical in toxicology for problems in waste water and integrated pest management.

Programs to correct manpower shortages should include:

1. Trying to get graduates to work in the public sector through such inducements as forgiveable loans;

2. Joining manpower and training activities with research grants;

3. Increasing the amount of co-oping; and

4. Seeking expert consulting advice to provide short-term technical skills.

A significant problem is how to get political skills to scientists and engineers so that everybody involved can agree on policy-making and execution.

MANPOWER ASSESSMENT IN A MISSION AGENCY (THE RECENT ERDA EXPERIENCE)

Norman Seltzer
Director, Manpower Assessment Office
Energy Research and Development Administration

The Energy Research and Development Administration (ERDA) is a new agency with its mission defined in the mid-1970's. It is not only new, it is so dynamic in fact, that the Manpower Assessment Office has been reorganized three times in one year!

The Manpower Assessment Office (MAO) is unique because the 1974 Energy Reorganization act is unique. That legislation charges ERDA with assuring an adequate supply of energy manpower though the collection, analysis and dissemination of necessary manpower supply and demand data. The Act also directs ERDA to do near and long-term planning and to build on, not duplicate the efforts of other public agencies and private organizations. This three-fold mandate forms the basis for the Manpower Assessment Office.

We are attempting to design systems which provide needs assessment information, develop plans based on that information, and to do it all in a cost-effective manner by using, not duplicating, existing resources.

A three-faceted program at ERDA responds explicitly to the three parts of our legislative mandate. A comprehensive information system will collect, integrate

and maintain base line data on energy manpower employment and utilization. We will develop methodologies for near, mid and long range planning, as well as for in-depth assessments; and finally, develop a positive program to work systematically with and use data from other agencies.

The Manpower Assessment Office is organizationally parallel to Education and Training. Both report to the Office of University Programs. Manpower Assessment is held accountable for identifying and documenting the needs which underpin education and training policy and program decisions. MAO also interacts with the various technology programs regarding their current and future program plans and possible manpower constraints.

MAO is still young - just past its first birthday, and dealing with data problems common to all of us. A large part of U.S. manpower data systems are rudimentary for the purposes of manpower planning. To compensate we have conceptualized a Comprehensive Energy Manpower Information System complete with acronym, "CEMIS". Unfortunately, names and acronyms are not enough. In a mission agency like ERDA, administrators want facts which provide a basis for policy decisions - not global data. For example, they ask, "How many nuclear engineers will be needed for waste management activities? Do we have enough geologists and mining engineers for exploration activities? How many technicians are needed for commercializing solar heating and cooling? Should any special action be taken to meet these needs?" They are only marginally interested in the traditional data, e.g., numbers of engineering enrollments or degrees awarded, or how many scientists work in private industry.

Thus, we are contemplating the use of yet another matrix (which had its origins in some work at NSF several years ago). One axis categorizes energy by source: gas, solar, coal and the like. Another axis lists processing stages: exploration, extraction, manufacturing, etc. In this manner energy manpower can be categorized in terms of coal exploration or extraction, solar manufacturing or development. In addition, MAO can aggregate by industry like gas or solar and for all of energy. Unfortunately, for elegant conceptualization, this mixed matrix includes manpower in the mature occupations of the coal industry, as well as the completely unstructured biomass conversion field, with solar heating and cooling, nuclear energy and the rest falling somewhere in between. It will be some time before it is known whether these elaborate matrices produce intelligence or garbage; whether there exists a firm base for needs analysis, or the extent to which energy manpower information can be organized as a homogeneous system.

As far as methodologies are concerned, there is an even longer way to go. Our chief conclusion to date is that the most sophisticated forecasting methodologies appear to have limited utility for our present purposes. Econometric models require large cells of information and fixed factor relationships. In many of the newer energy areas, on the other hand, most industries have few firms, small complements of employees, little or no fixed technology, and magnum magnitudes of changes in scale over short periods of time.

Although we are dealing with a post-space industry, the ironic fact is that we are forced to use the old methods. We're back to regressions, time series and informed guesses.

We have a little more experience with integrating data collection efforts to avoid duplication. Three clearly distinguishable sources of data exist, each with its own set of problems and opportunities - data developed by other ERDA divisions, data from other agencies, and cooperative ventures with other agencies to develop

new data.

In most cases data collected by other ERDA divisions can be used with minor modification. Data gathered by other agencies pose a variety of problems, most stemming from the fact that they are collected for other purposes. For example, a survey of Ph.D.'s in engineering and science does not specifically tab various segments of the energy sector. A re-survey and re-analysis of census data is needed to obtain information which we could use with confidence, because there is a difference between the degree of specificity census needs for a population count, and that required by manpower analysis to specify the qualifications and occupational attachment of members of the workforce employed in special categories.

The most promising approach to cost-effective assessments involves cooperative endeavors of several agencies. ERDA is involved with several other agencies in the National Construction Manpower Demand System; intended to produce data about construction skilled trades requirements by national, regional, and local areas and designed to meet the specific needs of each of its sponsoring agencies - TVA, DOL, ERDA, and FEA. Although not complete, it is already generating some information.

This is where we stand now. We have found that a legislative manpower mandate is great in concept but fraught with problems in practice. OMB wants manpower assessment now before it will authorize monies for education and training. Unfortunately, starting-up takes time; instant information doesn't exist. A lot of time has been spent scrambling to respond to current pressures while developing a long range strategy.

These pressures will continue for the foreseeable future. Certainly there will be continued emphasis on a demonstrable needs-program-results cycle and on cost-effective performance; and that means that we must learn to develop more cooperative ventures, more common data bases and more interactive strategies.

MANPOWER PLANNING IN THE BUREAU OF HEALTH MANPOWER

Howard Stambler
Chief, Manpower Analysis Branch
Bureau of Health Manpower
U.S. Department of Health, Education and Welfare

The Bureau of Health Manpower administers grants and contract programs to provide leadership in planning, initiating, conducting, coordinating and evaluating the nation's health manpower programs. Its activities include assessing and improving the quality and utilization of health manpower in education and training programs; improving communications, and developing facilities. It also develops legislation, and implements programs established by the Congress. It works to achieve distribution of health manpower to insure wide geographic access to health services; to assess health manpower supply and requirements; to develop health manpower policy and proposals; to stimulate interest and facilitate recruitment; and to coordinate DHEW health manpower programs.

Its resources in FY 1977 are a staff of 425 and a budget of $430 million for education and training. A total of $5 billion has been spent for training since 1965. The base legislation for health manpower is Public Law 94-484.

BHM has programs of institutional support for construction, capitation grants, primary care residencies, curricular improvement and other grants. Student assistance is provided in the form of loans and scholarships, some with repayment provisions.

The Bureau collects data on health manpower and makes analytical studies including health manpower projections. The data collection is on a 100% sample which is developed with the National Center for Health Statistics.

The Bureau looks at needs as well as demand, using matrices to show alternative results of particular kinds of legislation in health care.

BHM manpower analysis and planning activities include data development on current supply and services, current requirements, output of educational institutions, attrition and losses, geographic location and mobility. It makes supply and demand projections, both for individual specialties and area groupings such as hospitals. It identifies issues, and develops input for government policy. Ongoing work includes data base developments in optometry, pharmacy, nursing, public health, hospital manpower and education.

Supply trends and projections are based on profiles of individuals (obtained from institutional reports on grants). Data obtained from educational institutions includes the number of graduates and the capacity of the institutions, the location and specialty choice of graduates and their career plans. Even high school career plans are examined to see how many and what kind of individuals actually become medical personnel.

BHM produces background information for legislation. It must conform to the stated policy objectives; its cost implications must be considered, and the potential impact on supply and demand must be assessed. Appropriations will change programs. The Bureau must always look ahead to try and foresee some of these changes. Programs can change very rapidly, and data requirements change with them.

MANPOWER PLANNING FOR THE TEXAS WATER QUALITY BOARD

Tom Jackson
Manpower Trainer, Education and Training Staff
Water Quality Control Board, Austin, Texas

The Board employs 425 people plus those in district and regional offices; and has a budget of $200 million per year to build and upgrade water quality facilities. The Board is committed to the education and training of human resources to attain environmental objectives. It has two main activities - the building of waste water treatment facilities and providing personnel to insure water quality.

A manpower planning study is underway to examine manpower requirements for building treatment facilities through construction grants. Because manpower and training needs must be continuously updated, a computerized manpower information system, recommended by earlier studies, is being used.

Features of this system concept model include three main sources of manpower training demand data: Operation and Maintenance Reports from annual inspections of wastewater treatment facilities; TDHR Certification File containing data on the characteristics of certified water and wastewater personnel; and Construction Grant Files which provide data concerning additional manpower needed by new or expanded wastewater facilities.

From these source data, analyses can be made to produce estimates of current, actual and recommended employment, future employment levels, new hires and transfers, training loads, and manpower problems.

Procedures for obtaining information concerning training delivery are not currently available but can be developed. With consideration of manpower/training demand and supply, and manpower problems, specific training programs can be planned and procedures can be established to obtain information concerning the results of the training programs relative to what was planned.

Project tasks include establishing the project organization (administration, provision of analytical and consulting service), and establishing liaison with Texas agencies/organizations having manpower/training responsibilities.

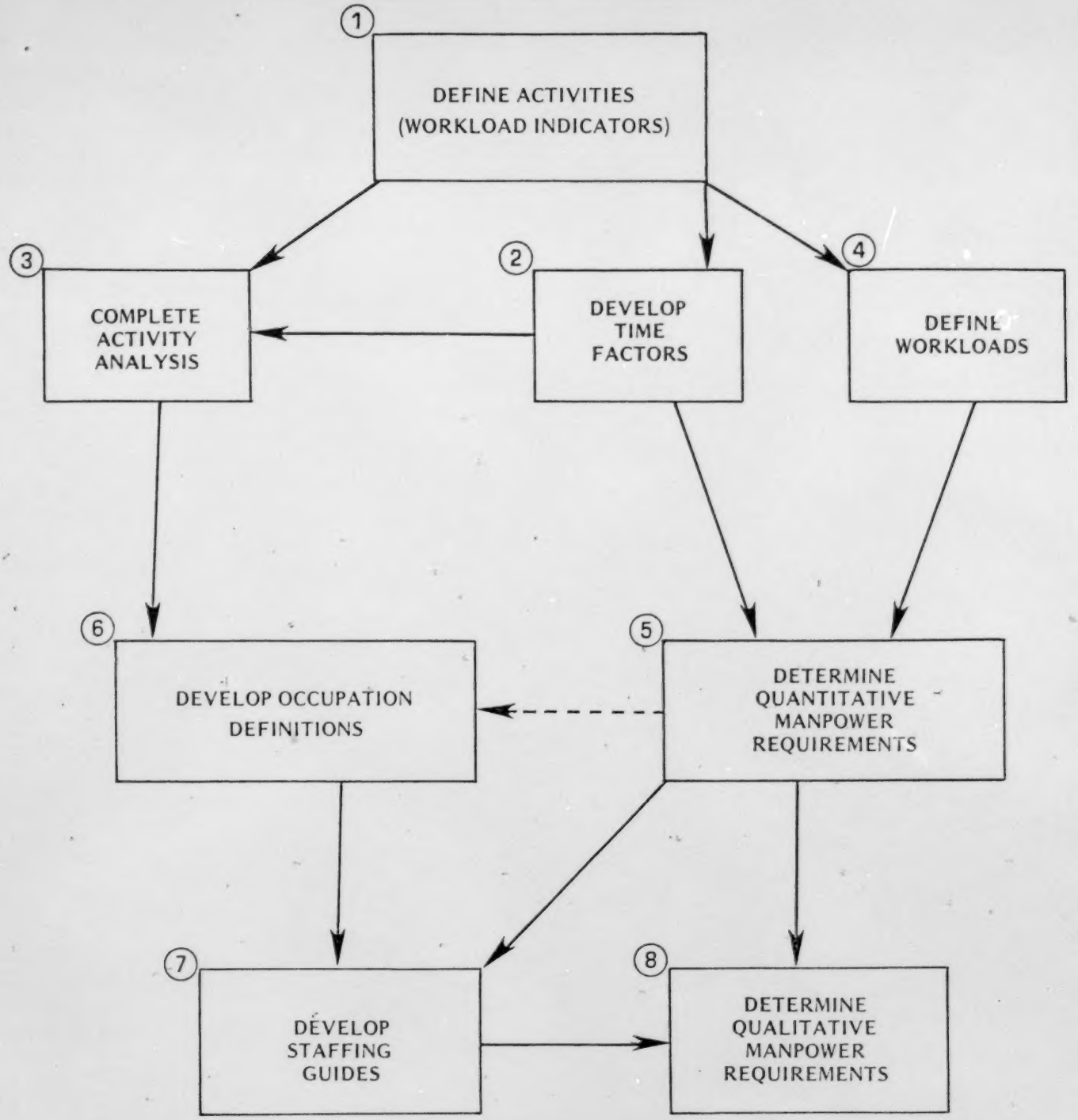
A requirements analysis will determine the information needs of the Board and other Texas manpower agencies/organizations. Input analysis will identify all sources and forms of data cited in the systems concept which are needed to produce the output requirements. Resource analysis will identify the resources necessary to support the requirements already identified, and a final report will synthesize data gathered in previous tasks and summarize system capabilities, processes, and outputs.

Specific outputs would be directed toward definition of workloads and work methods; development of planning criteria in the form of occupation definitions, staffing guides and work-time factors; development of an organizational staffing plan; assessment of current manpower supply; determination of recruitment and transfer actions necessary to fulfill staffing plans; identification of training needs; and identification of manpower problems.

The evaluation report will describe the approach and the resources required; identify immediate and future benefits and suggest refinement of the methodology.

EXHIBIT 1

APPROACH FOR DETERMINING MANPOWER REQUIREMENTS



MANPOWER PLANNING IN INDUSTRY

Herman Finkbeiner
Manager of Employer Relations
General Electric Company

We need a macro to micro transition for manpower planning as we convert from affirmative action type programs concerned with female and minority groups to those concerned with the needs of all individuals.

The Civil Rights Act of 1964 led to class actions and to individual cases. During recent years, the kinds of suits have changed toward individual cases.

To bring about equal opportunity, legislative action was required, but its success so far is dubious. There is a long way to go.

Some of the suits show how the actions have changed. McDonnell-Douglas vs. Green raises the question of a selection process for jobs. Griggs vs. Duke Power questioned diploma requirements and tests for employment. Robinson vs. Union Carbide concerned job applications, and raised questions of subjective analysis of employees such as maturity and aggressiveness. Albemarle Paper vs. Moody raised the question of EEOC criteria for applicability of testing procedures and whether this involved individual judgment.

General Electric is addressing these problems in terms of recruiting, training and promotion of women and minorities.

In the area of recruiting, quotas are sometimes operational, although they are not part of legal procedures except when ordered by the courts after a finding of discrimination. Evaluation by the company will require a change in the reports now obtained from campus recruiters so that selection can be evaluated in terms of comparison of applicants and understanding of why one candidate was chosen over others. In general, there is little documentation to indicate how the final selection process occurs.

There are several types of training, and the problem involves who is chosen for opportunities to take the training for upward mobility.

While GE has an open promotion system, it must consider past practices, the consequences of providing preference to minorities or females in such a system, or in not providing preferences. Hazards exist in terms of seniority, fairness, and convenience to the company in its promotion policies.

General Electric employs about 30,000 technical people. Attempting to be fair and convenient and to honor seniority while also working toward affirmative action presents problems. However, the consequences of affirmative action activities are long term improvement and monitoring on a steady basis, all accompanied by a substantial increase in paperwork. There is some question as to the productivity of either monitoring or increased record-keeping, since it now takes six people working full-time to shuffle and maintain the paperwork on each 2,000 employees. Nonetheless, the social and financial cost of not carrying out these programs would be intolerable.

The Civil Rights Act, and subsequent legislation, was needed, for a variety of reasons. This legislation has not yet accomplished its objective of eliminating and repairing the results of discrimination. There is still a long way to go, and the costs and problems do not provide easy solutions, but the efforts must continue.

MANPOWER PLANNING FOR SCIENTISTS AND ENGINEERS IN THE PRIVATE SECTOR

James Walker
Principal, Towers, Perrin, Forster and Crosby, Inc.

Scientific and engineering talent is a resource available on the open market, subject to competitive pricing and supply, as are other scarce resources. Yet in this area we find very little analysis of the forces at work or of their impact.

Particularly from the private employer's perspective, the labor supply for professional needs is assumed to be variable and beyond influence or control. Firms need not be government-dependent, as contractors, to be concerned with such talent needs. The larger employers, (G.E., I.B.M., Exxon, Gulf, Mobil, major utilities, etc.) in fact, are not primarily oriented toward government programs.

Private employers ride with the economic cycles, adding manpower supply in the upside and cutting back markedly in the downside. The 1971-1973 years in the aerospace industry dramatize the variability of private employer staffing.

From the vantage point of a management consultant specializing in corporate manpower planning, the following observations are germane to this discussion.

- Corporate manpower plans are extremely short term. Few companies project manpower needs in any meaningful way beyond one year. In high technology companies that rely on project management, six months may be the longest-range planning period for definitive staffing needs. However, many firms are adopting more rigorous manpower planning processes, generally as part of broader strategic business planning efforts. Even where forecasts are longer range, recruitment plans tend to be short range, hence of little use in labor market analysis.

- Companies lack knowledge of external labor supply. Frankly, private employers are not even aware of the types of information available from government agencies. If presented with BLS data or technical manpower supply/demand studies, most corporate manpower planners are at a loss to apply it to practical needs. The most valuable information from private employer perspectives is local labor market data on availabilities and going salary rates. These data are not available for professionals, and what is available (e.g., college graduates by degree area), is not particularly meaningful. Available data must be disaggregated to be useful to businesss.

- College degree specializations are not particularly useful data. Many engineers and scientists assume managerial or other careers, and the specializations are becoming less distinct as job requirements.

- Factor relationships change. Work analysis indicates that our traditional assumptions about professional work are not always valid. Chemical engineers and chemists cross lines; all are involved in managerial, administrative, and technical support work activities. The mix of activities on a position, and thus throughout an organization, determine the skills mix requirements.

Technological change brings needs for re-evaluation of position and organizational requirements, and business staffing needs. Private employers have only recently begun to analyze the patterns of career development and utilization of

scientific and technical talent. Perhaps we have a great supply of talent that is being underutilized, but private employers don't recognize or have not dealt with this. Of course, affirmative action and EEO requirements imposed on private employers have increased awareness, sensitivity, and activity.

- A trend is developing towards Matrix Management. Popular in the sixties, the concept is regaining favor, although not necessarily with the same labels. In R & D organizations, the concept applies to research, technical marketing, and other parts of traditional (not wholly project or aerospace) organizations. It allows monitoring of career development, recruitment, and staffing by function as well as by business activity.

Private employers are trying to develop more meaningful manpower plans, but the integration of private planning with publicly provided information and planning does not yet exist, and the need is not apparent to all.

PANEL II

ACTIVITIES AND CONCERNS OF ORGANIZATIONS WITH MANPOWER EMPLOYMENT, UTILIZATION, AND EDUCATION RESPONSIBILITIES

Specific Concerns addressed by this panel were:

- *Responsibilities of federal support and regulatory agencies relative to legislative mandates, employers and the individual.*
- *Activities in collecting and disseminating demand and supply information.*
- *Linkages with educational institutions, employers and professional associations in planning education and training programs for scientists and engineers.*

Richard H. Wilcox
Chief, Arms and Transfer Division
U.S. Arms Control & Disarmament Agency

It is tempting to differentiate the second session from the first by characterizing one as focussing on people responsible for doing something, the other on people responsible for knowing something. But closer examination quickly makes it apparent that the people concerned with applied programs are well aware of the necessity of good information; in several cases they operate some of the most effective data bases. Conversely, those people whose mission is to run data systems turn out to be highly sensitive to the requirements and interests by their applications - oriented customers. Success requires that data, analysis, and operations proceed jointly. Thus the second session in fact largely continues the pattern of the first -- presentations by knowledgeable people doing interesting things.

But in considering the degree of success of these various programs, it is useful to reflect on what constitutes success. In scientific and technical manpower matters we profess to think in terms of effective utilization of highly educated and skilled human resources. However, we may be oversimplifying our measures of this. For example, it is common to equate "underutilization" with working in a field different from that in which formal education is received. That is, if a chemist (by degree) is not doing something labelled as chemistry, he is considered to be underutilized because he is presumably not using his hard-earned specific skills and specialized knowledge. But this leads inevitably to the presumption that anyone working in a new discipline is underutilized. Were the scientists and engineers who created operations research during World War II underutilized? How many people in the field of scientific and technical manpower today possess degrees in that subject? And if they don't, do they consider themselves to be underutilized? Cross fertilization of disciplines by "field jumpers" may be healthy both for the disciplines and for the jumpers -- possibly even if the jumps resulted involuntarily from excess supply in originally chosen disciplines.

The authors represented in the second session are well aware of dilemmas like this. Although their programs are well thought out, they are not isolated in ivory towers. The designs are well tempered by experience in the complexities, uncertainties, and conflicting interests of the real world. Their papers are well worth reading both as guides to better understanding of the overall subject and as sources of practical ideas to try.

The source of the problem, of course, is that the things we want to know are seldom the things that we can easily measure -- and vice versa. Effectiveness of utilization of a scientist's knowledge and talents is extremely difficult to measure directly -- perhaps impossible on a large scale for a reasonable cost. Similarity between formal degree field and job title, on the other hand, is relatively simple to recognize and count. Thus it is not surprising that the latter is often used as a surrogate for the former. Whether it is a legitimate surrogate depends upon the application of the data. This difficult problem of matching what is reasonably measureable to what is really needed permeates the entire field of scientific and technical manpower study, analysis, and projection. Progress consists to a large extent in devising practical measures that correlate well with critical features of useful manpower models.

THE ROLE OF UNIVERSITIES IN MANPOWER PLANNING

Bernard V. Khoury
Associate Executive Secretary
Association of American Universities

Introduction

Universities play a major role in manpower planning for scientists and engineers. Their most important contribution involves the training and education of most people who assume leadership roles not only in science and engineering but in virtually every field of endeavor. The job outlook of today, which differs markedly from that of the last decade or two, means that a degree is no longer sufficient to obtain employment for college graduates. Even graduate degree recipients in some fields face profoundly altered employment prospects. However, as a college degree has become less and less sufficient to assume employment, the degree has also become an increasingly necessary condition for many positions especially in science and engineering.

Supply and Demand at Universities

The major research universities play a role both in generating the supply of trained manpower and in employing the same kinds of individuals. On the supply side virtually every scientist and engineer receives one or more college degrees. Also on the supply side the universities have another significant role which may be even more important in the long run than the training of technical personnel. As the impact of technology on our society grows, as energy, environment and technology increasingly conflict, as new knowledge increases on topics such as recombinant DNA and the development of nuclear energy technology, it is increasingly imperative that the broad society be better informed about the values, techniques, potentials and limits of science and technology. If our colleges and universities do not respond better to this growing schism in society then technological stultification might be the catastrophic ingredient in our manpower planning efforts.

On the demand side universities employ thousands of scientists and engineers as faculty, researchers, technicians and graduate students. The use of graduate students in our laboratories in turn increases the supply of advanced scientists and engineers. This self-replication by faculty is one of the most difficult problems in adjusting the supply to respond to reduced demands in some disciplines. As long as the university research system, in general, induces many institutions to emulate Harvard and Berkeley then faculty will continue to train graduate students who in turn aspire to faculty posts. The university system is very slowly responding to this problem but not without stresses and strains.

Universities and the Federal Government

The current conditions and the future prospects for most of our major universities are inextricably linked to the federal government and to its interest in manpower training. The federal government provides about $4 billion per year to undergraduate students in programs ranging from loans and grants to work, social security and GI benefits. In addition to these programs, the federal agencies provide major support to about one quarter of science and engineering graduate students including over one third of a billion dollars per year in fellowships, traineeships, and training grants. Colleges and universities directly receive about $4.5 billion from the federal government including over $2 billion in support of research. About two thirds of these research funds are awarded competively to a total of about 50 universities.

Fueled by this federal support of institutions and of students the nation has moved from a system of elite university education to mass higher education to near universal postsecondary education. In spite of some minimal growing pains and some significant cries of anquish during the recent leveling in of funds and students, I do not believe that there is any restoring the pages of the calendar. The nation needs its universities which in turn could not exist in anything like their current form without federal support. One fascinating question is how quickly universities will respond to the priorities, needs, programs, and statutes of the federal government and how onerous federal regulations will become in an effort to influence university actions. And through this inevitable tension, the most profound question is how well the national interest will be served by compromises between educational philosophy and federal objectives.

Should Universities Plan?

On the issue of manpower planning, or assuring a reasonable balance between supply and demand for scientists and engineers in the future, it is simple, at the risk of oversimplification, to the point to two extremes of the spectrum of attitudes about the proper function of major universities. At one end of the spectrum is the view that education and knowledge are valuable for their own sakes and that the proper function of universities is to inculcate timeless values and skills which can be readily adapted, after graduation, to specific employment needs. This view is more likely to be found in Colleges of Arts and Sciences but with some adaptation may also apply to professional schools. The other end of the spectrum is much more utilitarian in its perspective; at its extreme this attitude views the proper role of a university degree as preparation for specific employment. This philosophic dichotomy about the role of a university appears not only at the undergraduate level but can also be found at the doctorate level. The distinction manifests itself, for example, in the question of whether Ph.D. departments should deny admission to qualified and motivated students primarily because the job market for research scholars is profoundly depressed.

I have posed the above distinction as the extremes of a spectrum because I believe that the best resolution lies somewhere in the middle area. In fact there is no single best resolution. Institutions, and indeed individual departments, must and are more clearly articulating their own positions on the spectrum between broad intellectual enlightenment and specific job orientation. There are several healthy signs to which one can point:

1. Discussions of the job market are more open and more available to prospective students, both graduate and undergraduate.
2. Some graduate departments routinely inform all applicants about the job employment outlook for advanced degree recipients.
3. Some graduate departments are systematically reducing enrollments in response not only to reduced student support funds but also to thoughtful consideration of the foreseeable job market.
4. Quality assessments of programs including a look at prospective supply and demand for graduates are increasingly being initiated; some are being imposed (New York State) while most are generated internally within the university.

5. Rudimentary progress is being made in acknowledging that the effectiveness of a graduate program cannot be evaluated without first defining the mission and purposes of the program, often in terms of the target job market.

Recent Federal Manpower Efforts

Now I wish to discuss briefly three specific areas in which the federal government has turned to universities to generate trained manpower. In each case federal priorities changed dramatically shortly after the educational system had responded to the national manpower objectives.

About 20 years ago the federal government placed a high priority on greatly increasing the number of teachers at all levels from elementary school doctoral programs. The educational needs of the post-war baby boom and the impact of Sputnik on our national ego were two of the stimuli that led to massive growth in college and university enrollments, millions of dollars in federal fellowship and loan funds, and the establishment of hundreds of new institutions of higher education. The explosive growth in numbers of teachers was fueled by a clear federal priority backed by real federal money to students and institutions. The warnings of the late Allan Cartter about overproduction of Ph.D.'s were largely unheard during the euphoric era of exponential growth in institutional and student support.

When the nation's appetite for more teachers was sated, the federal programs were reduced but not before we had overshot our needs and supply greatly exceeded demand. Actual national needs, federal programs to respond to those needs, and institutional abilities to respond to federal programs were operating on different timing schedules. Without even considering the time to put a university program into place or to expand an existing program, teachers take at least 4 to 6 years to train while the federal government operates on a 12 month fiscal year.

The picture for supply and demand for scientists and engineers differs only somewhat from that for teachers over the past 20 years. Fellowship programs proliferated and then were abruptly terminated. Major federal expenditures increased not only the supply of scientists and engineers but also the demand for them. The NSF Science Development Program was designed to develop university centers of excellence in science. The program was completed and the funding was terminated at almost the same time as federal research expenditures fell, dropping manpower needs. Here again a mismatch between the timing of federal programs and the longer timing cycles of universities was clearly visible.

A review of the federal role in training of physicians reveals another significant issue in the interface between universities and federal manpower programs. By means of major capital expenditures, increased research funds, and capitation grants based on enrollments, the federal government aided and encouraged university medical schools to expand enrollments significantly. As soon as it was clear that the joint university-government effort to expand enrollments had succeeded, the government decided that the major health manpower problem was not an undersupply of physicians but rather a maldistribution of physicians by geographic region and medical specialty. Since the federal capitation grants (originally designed to increase enrollments) were still in place, the government (specifically the Congress) decided to impose new conditions on receipt of these capitation funds, conditions which were not related

to their original purpose and conditions which could have been better met by a different mechanism. Proposed statutes would have forced medical schools to alter curricula, to adjust residency and internship programs, and to assure somehow that medical graduates would practice in certain geographic areas and would specialize in certain medical fields. Additionally, medical schools were to be forced to admit transfer students assigned by the Secretary of HEW under a threatened loss of capitation funds. Although some of these objectives may be socially desirable it was clear that each one could have been better attained by a more specific federal inducement rather than a threat to withdraw capitation support. For example, a federal fellowship program to support transfer students would have focused on the specific government concern without raising anquished cries about "infringement on institutional autonomy."

From these remarks I wish to distill several observations about federal manpower planning and universities:

1. Federal manpower objectives can usually be best accomplished by positive inducements such as fellowships and grants that are specifically related to the federal objectives.
2. When the federal objective is accomplished or changed the inducement or bribe should be eliminated rather than using it to accomplish a quite different objective.
3. The use of regulations to attain a federal objective is much more effective if the regulatory mechanism is reinforced by a specific (financial) inducement rather than a threat to withdraw a program that the federal government considers a privilege and the institution may consider a right.
4. The educational and training cycle of universities varies from four to ten or more years. Federal programs typically have much shorter lifetimes. Federal policy should behave as though it was aware of this difference.
5. Federal policy should acknowledge the need to maintain very strong universities in the long run if these universities are to contribute to solving the nation's short-term needs either for trained scientists and engineers or for specific research results.

MINORITY WOMEN EMPLOYMENT PROGRAM

Howard Rosen, Director
Office of Research & Development
Employment and Training Administration
U. S. Department of Labor

The Minority Women Employment Program (MWEP) has been funded as a demonstration project by the Office of Research and Development (ORD), and run by the Recruitment and Training Program, with a subcontract to the University of Texas to undertake the research. It is showing dramatically successful results in placing unemployed and underemployed college-educated minority women in managerial, professional and technical jobs.

By identifying well-qualified minority women, coaching them to produce favorable interview and test results, instructing them in resume preparation, and making them available for job openings developed by the project, significant penetration has been made in companies which previously had little or no minority female representation among their better paying jobs.

MWEP devotes at least as much effort to employer contact and job development as it does to applicant recruitment and assistance. Researchers provide detailed information on growth industries, minorities and female employment, and individual employers who are likely to have professional job openings. Project staff interview these employers obtaining data on their operations, job openings, and hiring procedures, standards and schedules--and establish themselves as reliable sources for qualified workers.

More than 900 women have been placed thus far in occupations such as chemist, accountant, management trainee, and engineer. The project has come to be regarded as a source for higher caliber applicants by industry, with companies repeatedly turning to it for assistance in hiring. (About 65% of the placements have been in private industry; 10% in private non-profit organizations; and 25% in the public sector.)

Background

The MWEP has its origins in the findings by Professor Ray Marshall in his ORD funded study, "Negro Employment in the South," that well educated minority women were not able to get the professional jobs for which they were qualified, or any other jobs even remotely comparable in skill, pay or status. As a result, ORD suggested that the special techniques initiated by the Workers Defense League (renamed Recruitment and Training Program in 1972) to increase minority employment in construction apprenticeship be applied to minority women college graduates.

The MWEP was then set up. It was initiated in Atlanta in 1971, replicated in Houston in 1973, and expanded in 1975 to five other major labor market areas: Dallas, New Orleans, Tulsa/Oklahoma City, Cincinnati/Dayton, and Los Angeles.

It is important to note the following:

1. MWEP placements have experienced striking improvements in occupation and salary. Women who had been severely underemployed are now working at jobs commensurate with their skills. For example, women who had been clerks,

cashiers, receptionists, waitresses, and part-time secretaries are now auditors, corporate recruiters and trainers, programmers, sales representatives, and accountants.

Although some of the women had in fact been working in professional positions (primarily teaching) prior to MWEP placement, they were able to substantially increase their annual salaries through placement in "male-orientated" jobs. One women, for example, who had been a math teacher earning $9,300 a year, now is a management trainee in the accounting department of a communications company, with an annual salary of $13,800.

On average, women placed by MWEP increased their annual earnings by about $2,000. (The average annual salary obtained by college-degree placements has been about $10,500.) In addition, since they are placed in positions with upward mobility, they are likely to experience continued income improvement. Such additional earnings will, of course, yield greater tax returns over the years.

2. About half of the MWEP placements had been unemployed at the time of their application to the program. Further, the occupations of the MWEP placements are likely to insulate them more effectively from future downturns in the economy.

3. Women placed by the MWEP seem to show strong job stability. Follow-up returns on a sample of placements in Atlanta indicate that more than four-fifths of the women were still on the job of placement or in a related job for which the MWEP placement was a stepping stone.

4. Breakthroughs have been made by the project. For example MWEP placed (a) the first two minority women working in a professional-technical capacity with a large automobile manufacturer in Atlanta; (b) the first minority woman auditor in a major insurance firm in Texas; (c) the first black TV hostess in Atlanta; and (d) the first minority professional women employed by a Texas State regulatory agency.

NUMBER OF MWEP PLACEMENTS WITH A MAJOR IN SELECTED SCIENTIFIC AND ENGINEERING FIELDS: WHETHER PLACEMENT IS IN A DIRECTLY RELATED SCIENTIFIC OR ENGINEERING FIELD OR NOT

	ALL OFFICES*	
MAJOR FIELD OF STUDY	TOTAL PLACED	TOTAL DEGREED
Astronomy	0	0
Biology	9	13
Chemistry	10	11
Engineering	3	3
Geology	0	0
Math	36	43
Physics	2	2
Psychology	28	44
Biochemistry	2	2
Computer Programming/ Data Processing	4	4
Zoology	1	2
General Science	0	2
Health Science	1	1
Physical Science	0	1
Technical Science	1	1
Total	97	129

* All offices include Atlanta, Boston, Cincinnati, Dallas, Houston, Los Angeles, New Orleans, and Tulsa.

THE IMPLICATIONS OF FEDERAL POLICY ON STATE AND LOCAL MANPOWER DEVELOPMENT FOR HEALTH CARE

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Director, Division of Manpower Development
Pennsylvania Department of Health

U.S. expenditures for health care have grown to 7.2% of the Gross National Product, and the state of Pennsylvania represents a substantial portion of those expenditures. Pennsylvania currently has eight medical schools plus a number of autonomous medical societies; and produces more nurses than any other state.

A major problem is the decentralization of control with planning for health care needs and resources diffused among various organizations. Professional licensing boards are autonomous and not linked to public concerns and are proliferating rapidly. There are 130 more new licensing and credentialling boards since 1966. Departments of education also are licensing boards; state departments of health handle Medicare; and the Department of Welfare handles Medicaid. Frequently, local level skills do not intersect with federal incentives.

There are no linkages available at the federal, state and local levels to enable coordinated health manpower planning, and the demands for services are undetermined. Although health care now absorbs 7% of the Gross National Product, Pennsylvania has been unable to link its educational planning with employment needs in the professional sector. We expect that within the next ten years, there will be a decrease in physical facilities which will result in fewer entry-level jobs, particularly for minorities and women. At the same time, new incentives bring a larger supply of people seeking such jobs.

Manpower experts should examine both supply and demand in the health care sector including the physical constraints.

Wages have improved in health care, so more people will be seeking jobs in that sector, resulting in more competition. A decrease in facility construction will lower demand and yet CETA, and other legislation still provides incentives for entry.

Licensing is restrictive in allied health, which means that people cannot move across fields when demand levels change. The result of licensure has been to increase wage security and, more importantly, reimbursement ability, rather than to provide more consumer protection. Federal policies on reimbursement and other areas will affect the outcome in the future distribution of health care workers, but this influence has not been appropriately considered in terms of manpower planning.

Four development in Pennsylvania will affect future distribution of health care manpower. These are new policies of certification; emphasis on primary care; the expansion of HMO's; and the rapid growth in the number of M.D.'s. Pennsylvania exports 55% of the physicians trained in the state. At the same time, it provides $4,500 per student in capitation grants for medical students. No other allied health field gets so much, and nursing does not get any. The increased emphasis on these developments will strengthen the labor market for M.D.'s.

I would recommend that:

1. Current expenditures must be based on supply and demand.

2. Linkages must be developed between financing agencies, professional certification societies, and other factions of the health care delivery system.

3. Funds from CETA should be geared toward women and minorities.

4. Hospitals must be closed or opened in terms of health needs. Because limits on hospital construction will result in job loss to union labor, decisions about hospital construction are more likely to be made on the basis of union demands than on the needs of the community for health care.

5. A new labor market for M.D.'s is developing and special attention must be given to physician-extenders. While increased use of physician-extenders seems logical, the opposite is likely to occur as more M.D.'s are produced.

6. Finally, we should look at all health care personnel together as a package, rather than examining supply/demand for doctors, for nurses, etc. Federal policies on reimbursement for health care will affect the outcome and the future distribution of all health care workers.

NATIONAL SCIENCE FOUNDATION SCIENCE AND ENGINEERING MANPOWER DATA

James Brown
Director, Manpower Characteristics Studies Group
Division of Science Resources Studies
National Science Foundation

The National Science Foundation has primary responsiblity within Government for statistics and analysis of information on scientific and technical manpower resources. It maintains a clearinghouse of information on the training, supply, employment, and utilization of scientific and technical personnel and in other ways acts as a "focal agency" for the development, coordination, and analysis of statistical information relating to personnel in these occupations.

The responsibility for discharging this mandate has been given to the Division of Science Resources Studies. Within this organizational structure, the Manpower Studies Section carries out a program of manpower studies to provide the factual information essential for the measurement of the training and deployment of scientists and engineers. To achieve this goal the three major programs of the Section are focused upon data concerning the educational development of scientists and engineers, the characteristics of the existing pool of scientists and engineers, and their utilization in various sectors of the economy.

To monitor the flow of manpower into science and engineering, data from the National Center for Education Statistics are used along with the other information collected by the Foundation including the Doctorate Awards Survey. This survey is carried out by the National Academy of Sciences with support from the Foundation, National Institutes of Health, Office of Education, and the Endowment for the Humanities and provides one of the basic inputs to the Foundation's model which permits estimates to be made concerning the supply and utilization of science and engineering doctorates.

The Manpower Characteristics System, developed by the Foundation, allows for estimates to be made on the demographic, educational and professional characteristics of scientists and engineers. This system consists of three distinct but integrated subsystems. The first subsystem is the Doctoral Roster of Scientists and Engineers which is operated by the National Academy of Sciences with support from the Foundation and the National Institutes of Health. A biennial survey of a sample of doctorate holders provides information on this important segment of the science and engineering community. (The 1977 survey includes humanists as well as scientists and engineers and is being supported by NSF, NIH, and the National Endowment for the Humanities). The second subsystem, the National Sample of Scientists and Engineers, is maintained for the Foundation by the Bureau of the Census. This subsystem collects data biennially on a representative sample of scientists and engineers drawn from the 1970 Decennial Census. A third subsystem, the New Entrants Surveys, provides information on new nondoctoral entries into the scientific and engineering population. These surveys are conducted periodically. With the data furnished by the Manpower Characteristics System along with data from other Foundation surveys, other Government agencies, and private organizations, estimates are made as to the characteristics of the science and engineering manpower pool.

Data on the utilization of scientists and engineers is obtained by surveying employers in various sectors of the economy. The Bureau of Labor Statistics collects information for the Foundation on scientists and engineers employed in industry. Data obtained from the Civil Service Commission depicts the Federal Government's use of scientists and engineers. Periodic surveys of State and local government as well as nonprofit institutions, provide similar data. Universities and colleges are asked to supply basic data on the numbers of scientists and engineers in their employ.

In addition, the Foundation assesses the impact of changing national programs on technological advances. Included in this category are studies concerned with the flow of foreign scientists and engineers to the United States, the impact of computers on scientists and engineers, the effect of the pollution control and abatement program, the energy problem, the aptitude of graduate science and engineering students, and the status of science and engineering faculty.

Through all of these studies the Foundation's Division of Science Resources Studies attempts to provide the basis for national planning and policy formulation in the area of science and technology resources.

DATA RESOURCES FROM THE BUREAU OF LABOR STATISTICS

Neal Rosenthal
U.S. Department of Labor
Bureau of Labor Statistics

The Bureau of Labor Statistics' program most related to this conference on Manpower Planning for Scientists and Engineers provides information on current occupational employment, projected occupational requirements and prospective supply/demand conditions for scientists and engineers. In its initial stages, this program focused primarily on developing information for the use of persons making decisions about their future careers. Since the 1940's, when the program began, it has developed, matured, and expanded, but the primary focus remains the same - to help young people plan for the future.

Because of this focus, our primary publication, the Occupational Outlook Handbook, includes a variety of other types of information, covering such subjects as training requirements, salaries, working conditions, and the nature of the work in specific occupations. However, the inclusion of data on occupational outlook is the topic that has provided BLS with uniqueness in the career guidance information field. These widened objectives were spurred in part by legislation in the early 1960's, including the MDTA Act and the Vocational Education Act of 1963, which indicated that training programs financed by federal funds should be offered in occupations that provide favorable job prospects to those completing the programs. Since the mid-1960's the programs' objectives have been to reach persons planning education and training programs as well as young people planning their careers. The quality and comprehensiveness of our program on projected occupational demand and supply is the most comprehensive program of this type in the United States, and perhaps in the world.

Unlike most other programs that provide information on occupational demand and supply, BLS covers the entire economy - all industries and all occupations. It is a systematic approach which starts with the entire population and provides projected employment by detailed occupation. Through our techniques a variety of other valuable information is developed including projections of the labor force by age and sex, GNP final demand for goods and services produced by each industry, and industry employment. This information, of course is used for a variety of other purposes.

BLS' Products

The Bureau of Labor Statistics offers the following information and services:

1. Publications that provide current statistics on total national occupational employment by industry.

2. Data on occupational employment for over 200 industries in the industry-occupation matrix.

3. Projections in this same occupation by industry configuration.

4. Published information on projected job openings by occupation over the projection period, resulting from occupational growth and labor force separations. Data are published on current and projected employment and expected average annual job openings for 400 occupations.

Making Projections

For many occupations the results of a supply/demand analysis are published. For engineers, such publications include an analysis of the projected supply that may be derived from college graduates with degrees in engineering, college graduates with degrees in other fields, immigrants, reentrants to the labor force, and workers in other occupations who shift into engineering jobs. This information on supply is compared with projected job openings and an analysis is conducted that provides users with a better perspective of future supply/demand conditions than do demand data alone. It was this type of analysis that enabled BLS to project, in 1964, the likelihood of a surplus of teachers beginning in the 1970's; and in 1970, when the job market for engineers was depressed because of defense, space and R & D cutbacks, to issue a press release saying that in the mid-1970's job prospects for new engineering graduates were expected to be very good. That release was designed to tell young people not to forego an engineering career because of the depressed job market at that time.

The primary source of new supply, in most science and engineering occupations, is new college graduates. BLS uses the degree projections developed by the NCES. It is difficult to project college degrees accurately by field because it is difficult to anticipate how young people will react to the variety of factors that influence their choice of fields to study. Thus, great care is taken in the manner in which BLS presents information on supply in our supply/demand analyses. Basically supply is projected based on the currently observed trends, rather than on any anticipation as to how students will react to changed supply/demand conditions.

A variety of analytical techniques is used in developing projections of requirements, including regression analysis, input-output tables, and econometric models of various types. However, there is also a significant amount of judgment used in developing projections, and these judgments are manifested in a variety of assumptions made at every step in our procedures. Thus, it is not only the broad assumptions that relate to the unemployment rate and defense expenditures which affect the projections - but also assumptions concerning the future utilization ratio of technicians to scientists and engineers, trends in pupil-teacher ratios in colleges and universities and the study patterns of college students. These assumptions or judgments are based on an analysis of past trends; review of a variety of studies conducted by other government agencies, colleges and universities, nonprofit research organizations, and private organizations; and discussions with representatives of professional associations, unions, private industrial establishments, and with leading researchers in all employment settings who are working in the particular area we are studying.

Data Sources

The BLS data are gathered from a variety of sources. For example, the BLS model is based on the occupation-industry configuration of the 1970 Census which is embodied in a matrix which crossed 400 occupations with 200 industries. This matrix is updated annually based on data we obtain from the current population survey and on data obtained from associations - such as the American Medical Association and American Dental Association, which we believe compile better data on their respective occupations than we can get from other sources. We use data from the NCES on teachers, data from the Civil Service Commission, and data from a variety of other surveys conducted by Government agencies.

Of course, the use of data from this variety of sources results in many problems. We are attempting to solve some of them through the OES survey - a survey of employers in which data is gathered on nearly the whole economy over a 3 year cycle. This survey covers over 2,000 occupations rather than the 400 itemized by the Census, and therefore provides more detailed and complete data of better quality. The OES survey program is a Federal-State cooperative program in which data are collected by States in a format specified by BLS. Through lack of funds not all States are in the program, but next year we will begin to have national data since NSF has provided funds to BLS to gather data from those States not in the program. Thus, over the next few years the base data on employment of scientists and engineers will be vastly improved.

The OES survey to collect data on current employment also ties into a BLS-ETA-SESA cooperative program for developing projections of requirements by State and SMSA that are tied to the national data. Although this system was designed primarily to produce data on occupations for which vocational education is a primary training vehicle, it also provides more information than any other data source about prospective job opportunities in specific localities for college level occupations.

The Bureau develops a variety of other data to use in its analyses, and these are also provided to other individuals and organizations conducting occupational analyses. An important example is data on labor force separations. Information developed by BLS on labor force separation rates by occupations shows that more job openings occur from separations than from growth. Some recent work on occupational mobility will be important in analyzing supply and demand. These recently published data have not yet been used in any supply/demand analysis BLS has done.

PROJECTIONS OF EARNED DEGREES CONFERRED

Martin M. Frankel
Mathematical Statistician
National Center for Education Statistics
Department of Health, Education and Welfare

Earned degree reports from individual degree-granting institutions of higher education are received each fall by the National Center for Education Statistics. These reports show bachelor's, master's and doctor's degrees by sex for 24 major fields of study and for 416 subfields. The 1975-76 reports also show the racial/ethnic breakdown for the 24 major fields of study.

Projections of bachelor's, master's and doctor's degrees for 20 major fields of study are published annually by the National Center for Education Statistics in Projections of Education Statistics. Engineering and science categories included are: mathematics and statistics, computer and information sciences, engineering including engineering technology, physical sciences, biological sciences, agriculture and natural resources, social sciences and psychology.

How Projections Are Made

Current projections of bachelor's, master's and doctor's degrees by field of study are based primarily on the assumption that the percentage that degrees in a given field are of all degrees will continue the 1964-65 to 1974-75 trend through 1985-86 or else remain constant at approximately the rate for 1974-75. The projected

percentages for individual fields are then applied to projections of total degrees.

Related data from other NCES surveys and from independent sources are considered in making the projections by level and by field. The 1976 edition of Projections used data from: the NCES survey on enrollments for advanced degrees by field of study and first-time-degree-credit enrollment; reports on junior year enrollments, by field, for 1973 and 1974 as prepared by the Higher Education Panel of the American Council on Education; survey data on engineering enrollments and degrees collected by the Engineers Joint Council; survey data from the American Institute of Certified Public Accountants for bachelor's degree projections in accounting; data from the Health Resources Administration, Bureau of Health Manpower, for health-degree projections; and data from the American Institute of Physics for projections of physical science degrees.

Projections of bachelor's degrees by sex are based on the assumption that the percentage that bachelor's degrees are of first-time-degree-credit enrollment four-years earlier will follow the 1964-65 to 1974-75 trend through 1985-86.

Projections of doctor's degrees by sex are based primarily on the assumption that the percentage that doctor's degrees are of the average first-year enrollment for advanced degrees seven and eight years earlier will follow the 1964-65 to 1974-75 trend through 1985-86. Master's degree projections by sex are based on the assumption that the percentage that master's degrees are of the average first-year enrollment for advanced degrees one and two years earlier will follow the 1964-65 to 1974-75 trend through 1984-85.

Factors Which Affect the Projections

Projections of total master's and doctor's degrees are more sensitive to external factors than projections of total bachelor's degrees. The numbers of these advanced degrees conferred are affected by economic conditions, political and administrative decisions, and social conditions. Some of these factors are impossible to quantify, most of them defy anticipation.

The distribution of degrees by field at all three levels are also affected by external conditions.

As Betty Vetter has pointed out in Supply and Demand for Scientists and Engineers, in the early 1970's, young people developed a bad image of science and technology because of a perceived relationship with the war in Vietnam and an awareness of the dangers of environmental pollution. As a result, enrollments in engineering, physics, chemistry and mathematics dropped, despite increases in enrollments in all other fields. In addition, the publicity resulting from large cutbacks in the aerospace programs and the resultant unemployment of some highly skilled engineers and scientists, influenced young people against enrolling in science and engineering programs.

The large decreases in engineering enrollments beginning in 1971 led to projections of shortages of engineers. Reacting to the projected shortage, many students began entering engineering programs several years later (1974).

To the extent that students have reacted to the projected imbalance in the job market in engineering, and in other fields such as education, these projections have proven quite successful. However, to those making projections, the reaction of students to projected imbalances in job markets proves to be

self-defeating. Undoubtedly, it will be pointed out in some future evaluation of Projections that our engineering projections have been too low and that our education projections have been too high.

With this brief description of our degree projections and their basic assumptions and methodology, let me present some caveats that should be considered in using these projections.

- The properties of the methodology and assumptions, which determine projections, require that no false sense of precision be attributed to the numerical values of the projections. The numerical values should be considered only as possible future values.

- The NCES projections are descriptive in that no particular theories are presented to explain the observed trends. In addition to being largely free of theory, the projections are without value judgements and without advocacy of any policy changes.

- The figures for the next ten years are referred to as projections and not as forecasts, predictions, or policy projections. Forecasts and predictions combine analytical techniques with subjective judgments about the future. Since we do not have a crystal ball, we do not make long-range forecasts or predictions. Policy projections require the advocacy of policy changes. NCES does not advocate any educational policy changes.

The NCES approach is to apply mathematically the most recent trends to demographic data and to extrapolate the trends into the future. Where trends are changing, assumptions deemed most reasonable are made. There is, of course, no universal agreement on what are the most reasonable assumptions, and, therefore, the methods and data used to make these projections are shown in detail so that anyone who wishes to make other assumptions will be able to derive his own projections.

DISCRIMINATION - AN EVOLVING DEFINITION

Peter Robertson
Director, Office of Federal Liaison
Equal Employment Opportunity Commission

The Equal Employment Opportunity Commission is a regulatory agency. In order to regulate, it must first define discrimination in employment, a term which has evolved over the years. EEOC was established in 1964 without any enforcement power, but in 1974, enforcement was added to its authority when Congress found that employers lacked the technical perception to recognize discrimination. In 1964, discrimination was generally perceived as isolated acts of ill-will which were deliberate. However, by 1972, discrimination was seen as being more than bias or bigotry alone. In Griggs vs. Duke Power, a definition of discrimination was made based on the issue of the kinds of written tests that could be used as a basis for employment. The court defined discrimination as they perceived it and suggested a new way of thinking about employment systems. If an employment system operates to exclude Negroes, and cannot be shown to be job-related, the Griggs case declared it to be discriminatory.

The phrase "operates to exclude" leads necessarily to the use of availability statistics for the workforce. Courts and federal enforcement agencies look at the

employment statistics of an employer and compare them to the availability statistics on women and minorities to determine whether policies have "operated to exclude" minorities or women.

The real question arises in determining which statistics are the relevant ones. About two-thirds of those used by employers represent circular thinking, and the problem of breaking out of that circle is being laid on the employer.

One example of how this circular thinking may be examined is in higher education. The requirement that faculty members must have a Ph.D. may result in finding too few "qualified blacks or females." EEOC may decide that this shows discrimination if the Ph.D. requirement operates to exclude minorities or women, and may question the job-relatedness of the Ph.D. requirement. The Ph.D. may not be essential or even necessary.

In 1972, when the law was extended to cover higher education, this problem became a point of discussion in the Senate, when it was suggested that higher education should be immune to the requirements of affirmative action. The thrust of the discussion focused on the presentation of availability data and the Griggs case was discussed. One Senator cited data which indicated that persons without a Ph.D. could be a part of the available pool. If universities were required to show the relevance to the job of the Ph.D., would the percentage of doctorates on faculties decrease?

While the answer is not known, it is certain that universities along with other employers will be increasingly required to justify job requirements when such requirements operate to exclude appropriate numbers of minorities or women.

PANEL III

ACTIVITIES AND EMPLOYMENT CONCERNS OF SCIENTISTS AND ENGINEERS AS ASSESSED AND AFFECTED BY THEIR PROFESSIONAL SOCIETIES AND UNIONS; AND BY THE PUBLIC

Specific Concerns addressed by this panel were:

Data and services available to employers, government agencies and individuals from associations and unions.

Improving the quality of working life and dealing with job security problems resulting from national legislation.

Obtaining and disseminating information for career counseling, particularly for women and minorities.

Enhancing the public view of science and engineering.

Betty Vetter, Executive Director
Scientific Manpower Commission

Scientists and engineers are affected by federal programs and policies, both before and during their student days, and when they enter the professional labor force. They are additionally affected at an early stage in their lives by public perceptions of science and engineering and its practicioners, as relayed to them by their parents, their teachers, their guidance counselors, and the general public.

As students, they can be turned away from scientific or technological careers by these perceptions, as well as by the guidance they obtain, and this has, in the past, been particularly true for girls who sometimes have been steered away from the necessary mathematics courses and other preparation by their own acceptance of the mythology about female abilities and feminine pursuits.

Students who choose to prepare for careers in these fields may be affected by the availability of support, determined in part by federal policies.

Once in the work force, scientists and engineers face problems concerned with the job market; with employment standards and the qualities of their working life; with stability and security in their chosen careers; and with the public view of their professions.

Individuals acting alone often are less effective than groups brought together by their mutual needs and interests, which can act as a single unit to bring about needed change, provide mutual support, and serve common interests. Therefore, most scientists and engineers choose to join with others who have similar interests and face similar problems by affiliating with professional societies or with unions. These groups provide varying levels of services to members ranging from colleague support through continuing education activities to actual job negotiations related to working conditions and salaries. Some of them also produce manpower data in their fields, which is used also by the government in conjunction with other data. For example, Martin Frankel noted use by the National Center for Education Statistics of data from the Engineering

Manpower Commission and the American Institute of Physics.

The ability of scientists and engineers to perform their professional activities is both expanded and restrained by federal policies and practices, and by the actions of groups representing the public interest. Without federal support of their work, much of that work could not be done at all. Without public concern for the results of the work, much of it could not be funded. On the other hand, because of restraints imposed both by government regulations and public interest groups, the conditions under which they are allowed to perform their work include barriers that must be dealt with, one way or another.

This panel will examine some aspects of the counseling process particularly as it relates to girls; some of the activities and concerns of professional societies and unions who both represent and provide services to scientists and engineers; and some of the issues in manpower planning for a healthy science in the future, as viewed by the public.

POWER, PRESTIGE, AND HONOR: A DREAM FOR GIRLS, TOO

Mary Ellen Verheyden-Hilliard
Consultant, Washington, D.C.

In America we are fond of speaking of our democracy as one in which merit will be rewarded and all may aspire to that reward. It is, of course, a myth to half the nation's population. Neither girls not those who educate and rear them believe that little girls should dream of power, prestige and honor when they are grown up. Although there are some individual parents and individual educators who take a different tack, for the most part, American girls are still socialized to the Cinderella Syndrome. The Cinderella Syndrome assumes that a girl will only want to work or need to work for a little while until she is carried off to the castle by the Prince where she will live happily ever after with never a need to be independent because she will be "taken care of" her life long. Her power, prestige, and honor need never stem from her own efforts, but will come vicariously through whatever second-hand status she is able to derive from the Prince's position.

We continue to socialize girls to this myth in spite of well publicized census bureau statistics which tell us that almost half the entire American labor force is female, that 54 percent of all American women between the ages of 18 and 54 are in the labor force, that 1,000,000 marriages ended in divorce in 1975, that men die sooner than women, and that two thirds of all the poor people over the age of 65 are women.

We continue to bring up little girls to believe that total financial dependence is an acceptable way of life for an adult woman. This has resulted understandably, in the failure of girls and young women to see any reson to pursue a rigorous academic plan leading to a life-long career plan. Women work primarily in low-paying dead-end jobs which provide no career ladder up and no salary scale to make the position worth while. The majority of women who work are either in clerical or service occupations such as beauticians or waitresses. Of the tiny percentage who are in professional positions, the majority are elementary and secondary school teachers. The career ladder up on these positions can best be demonstrated by noting that of over 13,000 school superintendents in the United States, 65 are women. Among scientists and engineers in the labor force, only 5.8% are women.

Through the school years we reqard the conforming, good little girl who causes no trouble and follows directions and is popular with males. We ignore the evidence long before us that we are socializing with almost deliberate precision to behavior which may lead to less intellectual achievement.

In the Fels Institute longitudinal study of gifted children, the boys and girls whose IQ rose during elementary school were those who were assertive, independent, and dominant in interaction with other children. The boys and girls whose IQ's fell were passive and shy and dependent. The National Assessment of Educational Progress revealed in 1975 that girls tested equal to boys at age 9 but by age 13, began to fall behind in math, science and social studies and the downward trend continued through the late teen years and into adulthood.

The research indicates that educators, on whom a girl is dependent for educational and career information and help, treat her in a stereotypic way and that the males with whom she grows up are, at every age except kindergarten, less favorable than girls of the same age to concepts of change that would grant women greater participation in the social, economic and political life of the world; are less willing to let women into prestigous occupations; and are less willing to participate in an equitable way in the sharing of the tasks required to keep a household and family operating. The final irony of the "liberating" affect of a college education may be seen in the survey of Ivy League male students which revealed that only 7 percent of the men were willing to change their role in any way in order to help a future wife pursue a career.

When I directed the Sex Equality in Guidance Opportunities (SEGO) Project (the first nationally coordinated effort by the Office of Education to provide Technical assistance to educators in every state on sex equality) I learned a great deal from the 7,000 educators who participated in SEGO's 300 workshops.

The clearest message was that they, too, were locked in the Cinderella Syndrome and that although they would encourage girls to plan for "multiple roles" of wife, mother and career woman, power, prestige and honor as a goal for girls had not yet entered the picture in any significant way. Neither was any significant effort being given to boys to help them understand and learn to cope with the fact that their way of life as adult men will be changed as new paths open to women.

There is no single place to intervene to end the perpetuation of this disabling disaster. For those with the power to do so, intervention must begin everywhere, and at once. Girls and boys must learn to encompass the idea that it is important to aspire and achieve independent of potential marital and parental status, and that truly adult human beings will understand the necessity for all members of a family to contribute to the family's emotional and financial well-being. As has been noted, it is child care and not child bearing which causes the most long range problems for families. With that fact firmly in mind, the next point is obvious. Child care can be done by a loving parent - male or female. Child care is not a "woman's problem." It is the concern of every person who chooses to start a family.

It may, perhaps, be useful to begin "at home." As Virginia Woolfe said, the personal is the political. To look at a daughter or a grand-daughter and consider whether you would like her to be forever dependent on someone else's largess (which, the statistics tell us, is quite unlikely to be enduring) or

to be a person secure in her own ability to achieve and maintain financial security, is to begin to understand what must be done for all girls. The goal of power, prestige and honor is part of the American dream. And the American dream belongs to girls, too.

THE IMPACT OF THE AMERICAN CHEMICAL SOCIETY ON EMPLOYMENT CONCERNS OF SCIENTISTS AND ENGINEERS

Robert Neuman, Head
Department of Professional Relations and Manpower Studies
American Chemical Society

The American Chemical Society is only one of many associations whose members are individual professionals rather than organizations or corporations. However, the ACS is larger than most societies that represent individual scientists, and it has undertaken a large variety of projects intended to benefit chemists and chemical engineers--in their education, in the pursuit of their professions, and in specific employment situations. A brief description of a few member-oriented ACS activities can illustrate what professional societies do on behalf of individual professionals. Many of these activities also serve employers, government agencies, and educational institutions.

The American Chemical Society's national charter, enacted by Congress in 1937, influences the kinds of activity the ACS can pursue. ACS was federally incorporated to encourage in the broadest and most liberal manner the advancement of chemistry, the promotion of chemical research, and the improvement of chemists through high ethical standards, education, and attainments. ACS cannot be a lobbying organization, but is required by its charter, upon the government's request, "to investigate, examine, experiment, and report upon any subject in pure or applied chemistry connected with the national defense."

The Society is permitted to spend only an insubstantial portion of its funds directly on activities aimed at improving the professional status of its members. However, because the budget for this society of over 100,000 chemists and chemical engineers has become quite large, the use of even a small part can have considerable impact upon the professional status of chemists and chemical engineers.

Services to Members

Since the depression days in the thirties, the ACS has been concerned about employment and other professional problems of individual chemists and chemical engineers, and has had committees and staff to deal with them. The Society's weekly news magazine provides a place where both employers and individuals seeking employment can advertise. In addition, the Society maintains an employment clearing house at its headquarters on a year-round basis and also provides the means at semi-annual national meetings for employers and prospective employees to come together for employment interviews. The ACS also has developed professional employment guidelines in an effort to maintain high standards both in the job performance of individual chemical employees and in the treatment they receive from employers.

Career Counseling Information

Career guidance is provided through the dissemination of literature and through work with a nationwide network of student affiliate chapters. There is a Women Chemists Committee to emphasize career guidance for women and to seek solutions to the special problems faced by women working in chemistry. There is a task force on the problems of minority chemists and a subcommittee for the education and employment of the disadvantaged.

Education Services

An important part of the services available to individual chemists and engineers is the continuing education program, which is available in many forms--intensive short courses of two or three days duration, correspondence courses, film, tape cassettes, and soon a specialized use of television.

The ACS has contributed to development of high school chemistry teaching, and at the college level, the ACS has a procedure for approving college departments of chemistry that meet certain minumum standards set by the Society. Nearly all the major institutions in the country, from which most chemists receive their degrees, are now on the ACS approved list.

Links with Industry

The ACS does not represent the chemical process industry, but maintains a useful linkage with the employers of chemists and chemical engineers through ACS Corporation Associates. Cooperative mutually beneficial activities involving both educational and industrial communities are organized by the ACS. Through the ACS Committee on Chemistry and Public Affairs, with staff support, many chemistry-related projects in the public realm are explored, and comprehensive reports are generated. The Society studies problems of energy conservation and environmental protection, and provides testimony in Congressional hearings on legislation that may involve chemical science or professional scientific manpower.

Manpower Data Studies

Undergirding much of this ACS activity is a program of manpower surveys and reports conducted by the Office of Manpower Studies. These include annual surveys to determine trends in chemical salaries and employment status, starting salaries of newly granted chemists and chemical engineers, and the numbers of chemists and chemical engineers graduating at the various degree levels. Special studies have been made on the economic status of women and on chemists accepting postdoctoral positions. In each of these past two years we have conducted simple surveys to ascertain the availability of teaching positions in chemistry. All these findings are made available to educators, industrial employers, and government agencies. We try to integrate ACS data on science manpower with those from other sources, especially government agencies. We have made a few attempts at forcasting, of both the likely supply and the prospects for employment.

These manpower studies can lead to rather disturbing conclusions about future demand for conventionally trained chemists and they indicate a need for evaluating chemical education--perhaps all college education. The size of the

college age population has been growing more rapidly than the total U.S. population since 1955, and it is projected to peak in 1983. Colleges and universities expanded during the nineteen fifties and into the sixties and received great infusions of government money which aided the expansion and encouraged young people to obtain scientific training to meet the needs of the space program. Financial support began to wither in the second half of the sixties but the educational machinery has acquired considerable momentum. Little thought was given to changing the educational emphasis.

As we entered the seventies we suffered a severe employment crunch for scientists and engineers, and found educational institutions producing more scientists and engineers than the market seemed able to absorb. There now appears to be a danger of a worldwide glut of college graduates. Some serious thought should be given to the whole matter of worldwide manpower planning and to possible changes in the role of educational institutions.

Dr. Alan McClelland of the ACS Committee on Economic Status has studied some of the trends in data gathered by the Society. Less than 20 percent of last year's graduates with a bachelor's degree in chemistry went into full-time chemical employment upon graduation, as compared with almost 40 percent in 1958. In 1954, bachelor's degree chemists and chemical engineers started their careers at approximately equal salaries, but the engineers' salaries have been gaining steadily vis-a-vis those of chemists, so that now engineers' starting salaries are 32% higher.

The proportion of new Ph.D.'s accepting a postdoctoral position as a first job has increased steadily from 15.7% in 1960 to 48.7% in 1976. In 1976, more Ph.D.'s accepted postdoctoral positions than any other kind of employment, indicating that a good proportion of them are entering a holding pattern until suitable employment opportunities are found.

In view of these trends, Dr. McClelland suggests the alteration of chemical education in such a way as to broaden the job opportunities. One useful alteration would incorporate more engineering and practical technology in the total curriculum of chemistry majors. Suitable modifications of the curriculum could make students in chemistry not only better able to function in nonresearch positions, but also better able to perform in nonchemical careers.

In view of the manpower trends for scientists nad engineers, the educational community is urged to consider changing its traditional course and developing new goals for scientific education.

ACTIVITIES AND CONCERNS OF PROFESSIONAL SOCIETIES IN PHYSICS

Beverly Fearn Porter
American Institute of Physics

Introduction

The major goal of the physics and astronomy communities is to further the development of these fields by advancing the knowledge of physics and astronomy and its application to human welfare. To accomplish such a goal it is clear that meaningful career avenues for individuals must be kept open, that opportunities for women and minorities must be furthered, and that the public understanding of physics and astronomy must be advanced.

The relationship between the physics community and the government has been an important one. In the 1960's physics and astronomy received substantial federal funding for research and manpower development programs. It was difficult to believe that such halcyon days could end, but they did. The effect on the physics community was traumatic. From the "Golden Ones" of the 1960's, we became the proverbial newspaper cartoons of the 1970's. Luckily the "nuclear physicists driving taxicabs" is decidedly atypical, but it symbolized the trauma many physicists have faced.

Since then the physics community has become somewhat more cautious. Although it will always have a strong relationship with the government, it may not be quite as ready to leap onto every new government bandwagon that comes along. The late Allen Cartter said that the economic traumas of the early '70's could be viewed as positive, if we saw them as a lesson to start looking ahead and begin considering the problems which will be looming in the last two decades of the century. The physics and astronomy communities are trying to do exactly that!

Data and Services Available: AIP-APS

The American Institute of Physics has a long history of manpower data collection and analysis. It has monitored the supply of physicists through its enrollments and degrees surveys of department chairmen for more than fifteen years. It has also directly surveyed new degree holders and graduate students on an annual basis. To keep track of the utilization of physicists after the decease of the NSF National Register, AIP and APS conducted their own employment and demographic survey of the physics community in 1973. Presently several follow-up studies examining the employment situation and attitudes of academics denied tenure, industrial physicists, mobile physicists etc. are being conducted. Studies of demand have been more limited. Two studies, one of academic and one of industrial demand have been undertaken.

All recent manpower data collected by AIP are on tape. Reports are published regularly and special inquiries are dealt with throughout the year. The users are many, ranging from department chairmen, faculty, students and individual physicists to industrial companies and government agencies.

The Institute also conducts a year-round placement service, assisting both physicists and employers by acting as an information exchange. Registrants with the service are sent open position listings monthly and searches of registrant files are done at employer request. Recently the American Physical

Society has developed a small program of industrial fellowships, aimed particularly at companies which have not typically employed physicists in the past.

Career Counseling Information

While individual physicists will continue to make their own career decisions, data and description of the actual employment situation can provide useful guidelines. An employment counselor has been available at society meetings and for several years at the Institute itself. A network of employment information officers at graduate physics departments has been established. In addition to disseminating general employment and more specific job information, many of them are able to provide career counseling for the young physicist. In addition new career booklets are beginning to emerge.

Career information and counseling for women and minorities in physics involves more extensive problems. Women and minority group members are a very small proportion of the physics community. The American Physical Society has a Committee on the Status of Women in Physics and a Committee on Minorities which have been active in dealing with the concerns of these groups.

The Committee on the Status of Women in Physics has conducted several studies, produced reports to the APS Council, and run special sessions at society meetings. In response to the cry, "but we can't find any women physicists" - they published rosters of over 1,500 women physicists in 1972. They have produced a career booklet "Women in Physics," directed at high school and beginning college students, which describes the varied nature of the field of physics, dispels some of the myths surrounding employment of women in science and describes the lives and careers of several women physicists today. Clearly problems of role models, recruitment, and actual discrimination all need to be addressed if women and minorities are to contribute their full potential to the field of physics. There is growing recognition of this in the community and increasing activity.

Enhancing the Public View of Physics

Particularly in the 1970's the physics community has come to realize how crucial to the continued health development of the field is an increased public understanding of physics.

The physics community has reached out through its creative public relations activities to today's public, and through its increasingly innovative course offerings to the public of tomorrow. Press conferences and topical seminars are given for science writers at meetings; author-prepared, lay-language copies of physics papers are distributed to colleges and universities. Presently, several minute radio spots are being developed which feature such provocative and interesting topics as: Fire Physics, Earthquake Predictions, Physics of Karate, Noise and Behavior, and Mirages. Physics is clearly a part of people's experience! Innovative physics courses for liberal arts and other college students are also being developed with the recognition that the public of tomorrow will need more scientific sophistication than the public of today.

Through data collection, placement activities, career counseling and continuing efforts to further public understanding, the physics community has taken major strides to "help itself" face the problems of the coming decades.

EMPLOYMENT CONCERNS OF SCIENTISTS AND ENGINEERS

Frank Collins
Oil, Chemical and Atomic Workers
International Union, AFL-CIO

Career Counseling

Counseling in departments and schools of engineering and science is not in a good state. Career counseling should begin before admission by an academic institution and should be part of the admissions procedure. Instead, students are often given sales talks on why they should select science or engineering as a career and, in particular, why they should select the given school.

After admission, counseling reaches only the more tragic cases. Fifty percent of the undergraduates in most engineering schools leave engineering before graduation. Many go away defeated and demoralized. Some should never have entered engineering or science in the first place, because their abilities, aptitudes and interests were not well suited to their fields. Career counseling at the start of the academic career can be critical.

Technological changes and technological shocks, such as those arising from the energy crisis, are likely to be recurring phenomena in the comming period. The problem is how to minimize the human damage of these changes and how to provide adequate and competent manpower in fields that suddenly became vital to the nation.

Prediction of manpower requirements made by projecting existing trends does not allow for unforeseen events and general surprises. The recession in the aerospace industry commencing in the late 1960's and the solid state fundamental research slackening at about the same time are both illustrations of the fallacy of long range predictions based on historical trends. Manpower projections have some degree of influence on students' choices of careers, dissertation topics and jobs on graduation, but there is a lag of four to nine years between career choices and entry into the chosen profession, depending on degree level.

This time period is long enough for some predictions to demonstrate themselves as false, but the mistakes have been made.

Employment Problems

For employed scientists and engineers, these uncertainties in the future of any specialty mean that individuals can not be certain of a lifetime career in their chosen professional field. Even so, some have this illusion of permanency and they are severely jolted when they become surplus commodities.

A major problem is the lack of versatility of many scientists and engineers. This means that they are not readily employable in other allied fields and specialties in the event of layoff arising from shifts in technological development. This is difficult to resolve. Science and engineering succeed because problems are solved by specialized knowledge of all of the required fine details of a given physical situation. This need for specialization is reflected in the character of undergraduate curricula, graduate research and working experience on most industrial jobs.

However, for the individual, the result of this emphasis on specialization may be obsolescence. The directions of technology and research change with time, leaving the over-specialized high and dry.

University faculties long ago established the sabbatical policy, which gives the professor a change of venue and the opportunity to branch out into new fields of study. Some professors make this the occasion of a major change in their area of research. Most use the time to extend their knowledge of adjacent fields bearing directly on their principal research interest. In either case, it is a time for renewal and for breaking the habits leading to professional obsolescence.

The sabbatical is not an established policy in industrial research and development. From management's point of view, the money would be wasted if the employee left his job after the sabbatical experience. However, the more probable result is that the sabbatical would lead to a continuing infusion of fresh ideas into the laboratory or engineering department. From the standpoint of public policy, if scientists are to be regarded as a valuable national asset, then the industrial sabbatical would serve the national interest by counteracting the depreciation of this asset through professional obsolescence.

Layoffs

A layoff is a rude shock to the professional employee who feels that he or she is doing well at work. The immediate result is demoralization, making the search for substitute employment doubly difficult.

Lay-offs mainly take place during economic recessions when more people are chasing fewer jobs. Although some individuals find employment, statistically there is a pool of unemployed scientists and engineers. Schools in resume writing may help individual scientists, but statistically no new jobs are created.

What is the composition of those selected for layoffs? The first to go are the young employees still in their extended probationary period. But the typical scientist or engineer laid off is middle aged, has years of experience in a narrow field and is reluctant to move because of roots in his community after years of employment there. This type of professional employee is sometimes coldly referred to by top management as "dead wood." However, management policies largely contribute to this situation. There is another more crass reason for the preferential lay-offs of middle aged and older employees. After years of merit and other raises, the older employee simply costs more than a younger one.

Although the law now prohibits discrimination on account of race, sex or age, discrimination in lay-offs of the older groups of employees is both difficult and expensive to prove, although there have been some recent successes in this direction. Professional employees still need a good union to look after their interest in the matter of lay offs.

How do personnel departments determine who to hire? In large companies, formal job criteria such as degrees, prestige of the school, number of papers, patents, years of experience, job titles, etc, may be established and then matched against applicants. A candidate may be found to be either for the job qualified or overqualified, according to the criteria established for the job. While these may be valid reasons for not hiring, too often they are catch phrases used to inform unsuccessful candidates after the hiring decisions has been made.

Reducing Supply/Demand Imbalances

In conclusion, the primary task remains the projection of future trends in scientific and engineering employment and getting this information to scientists and engineers and to students considering careers in these fields.

To be useful, these predictions of manpower demand must not be simple projections of existing trends. Assessment must include the consideration of potential new technologies, their chances for expansion and estimation of resulting manpower needs. At the same time, existing manpower needs must be carefully assessed with respect to their chances of withering away. This is a difficult but highly important task in a coming period of rapidly changing technologies.

PUBLIC INTEREST CONSIDERATIONS FOR MANPOWER PLANNING IN SCIENCE

Nancy E. Abrams, Consultant
Office of Technology Assessment

This talk may seem to be about women and minorities in science. It is not. It is about the health of the scientific and technical enterprise in the U.S. today and the chief issue in manpower planning for a healthy science in the future.

The National Science Board compiled a report last year entitled Science at the Bicentennial: A Report from the Research Community. Its purpose was to define the critical issues or problems for science today which "would decrease the effectiveness of research unless properly addressed." Over 900 top-level administrators of research in universities, industry, federal laboratories, and independent research institutes were asked to write their opinions as to the two most critical issues for scientific research. Complaints included insufficient irregular funding (universities), excessive government regulation without a coherent science policy (industry), and from all four types of institutions, the perception that the public neither understands or appreciates basic research and has a "negative attitude" toward it. The most relevant concerns for our purposes, however, were these: the best young people are not going into science and engineering, at least not in industry (industry); and the continued supply of manpower to do research must be assured (universities).

Despite common fears of a decreasing pool of real talent in research, it did not occur to these people in key positions that the de facto exclusion of women and minorities from the scientific enterprise is more than halving whatever talent would otherwise be available, and that the unwillingness or apparent inability of the enterprise to remedy this situation is a critical problem by the National Science Board's own definition. I began counting the names of people from whom opinions had been solicited. Of 433 from universities, 5 were women's names. Of 113 from industry, not one was a woman. At that point I stopped counting. I may have missed one or two whose names were foreign or in initials, but the difference would be insignificant. Even if every woman on the list had given highest priority to the imbalance of men and women in science and the institutional impediments to women entering the sciences, a concern of only five people would not have been mentioned in the summary report.

The only mention of affirmative action for women and minorities was as a "burdensome requirement" and as a cause of "anti-intellectualism, a major component of which is an anti-science attitute."

Manpower planning, by definition, looks to the future. These individuals responding to the National Science Board, who represent the uppermost echelons of science and technology in this country, say that the pool of top talent going into science is dwindling, and that the public has a poor understanding of science and a negative attitute toward it. Their suggested solution is to "convince" the public (including Congress) of the importance of science and technology so that the scientific enterprise may have more, and more stable, funding, with fewer requirements imposed from the outside. At no point in that report is there any recognition that the public could be right: that "negative attitudes" might have some justification; that solutions to some of the critical problems might be more difficult than just adding funds and reducing interference; in short, that long-term solutions might require changes in the scientific enterprise and the intellectual courage to recognize what such change would mean.

There is today a small but influential movement afoot called "public interest science" in the U.S. and "critical science" in Britain. Public interest science attempts to bring out unspoken or unnoticed dimensions of policy issues in science and technology, compelling decision-makers to confront the social, economic, and human implications of the choices before them. Public interest scientists may act on their own, in writing as members of advisory committees, or sometimes as whistle blowers; or they may provide technical assistance to environmental or consumer groups defending interests or values against technological impositions designed with apparently little or no regard to harmful effects or more acceptable alternatives. Whatever form the activity takes, however, its purpose is essentially the same: to bring into public debate the hidden assumptions of the scientific and technical enterprise and the diversity of human values and needs which must play a role in the formation of good and legitimate science policy.

The effort to open science and technology to women and minorities is a central, though still little-recognized, part of public interest science. It too attempts to expose the assumption of the scientific establishment as to

1) the kjnd of person most "suited to science,"
2) the meaning and measure of "intelligence,"
3) the meaning and measure of "success" and "prestige" in science,
4) priorities in scientific research,
5) ethical values in science and their role in R & D.

Public interest science also attempts to inject into public debate the values and needs of a vast, ignored constituency -- over 60% of the population -- which has been largely excluded from the policy-making process in science and technology, from the formal decision-making levels of advisory committees and peer review panels and from the de facto individual decision-making of the scientist about the direction of his own research.

Manpower specialists have pointed out that with the end of the growth period of the sixties, scientists may have to become more versatile and able to shift to fields where demand exists if they want to stay employed. Retraining, however, will never succeed in assuring a balance of people among fields where

They are needed until the problem of allocation of prestige is faced. In basic science, the prestige of a field increases with the distance from human beings. Why?

It was mentioned earlier that we face a glut of educated people. This is an incredible statement. It can only have meaning in a system so distorted that education is worthless unless it can get you one of a disappearingly small class of prestige jobs. Yet it is education that can make people free, both individually and on a global scale. Women and minorities in science are challenging this concept of prestige. What R & D is really in the public interest? Shouldn't prestige be somehow tied to that? Shouldn't a functional definition of "intelligence" somehow take into account one's sensitivity to human needs and one's ability to require of his or her intellectual processes that they be in harmony with that sensitivity?

The future health of science depends not only on opening the manpower pool to all talent, regardless of race or sex; it depends also on openness of inquiry, and on the pursuit of knowledge whose value is not prejudged. I would like to mention a few examples of research in areas previously unexplored or discounted as trivial. June Shaup-Hummel is doing research on female voice and speech patterns after discovering that almost all research done on the "human" voice used male voices. Jean and John Lennane are examining female and child disorders such as nausea in pregnancy, menstrul pain, and colic, which have often been assumed to be psychogenic despite evidence indicating organic causes. Rohrlich, Leavitt, et al have pointed out that anthropology tries so hard to fight ethnocentrism that it fails to note the androcentrism for which the male ethnographer is not held responsible even in his own culture. In applied research, both men and women scientists have noted the bias toward research on exclusively female contraceptives and some are now engaged in research into possible male contraceptives.

Long-range manpower planning will have to account not only for numbers of people and fluctuating demand among fields, but for qualitative changes not only in fields and directions of research but in the range of social values to be accommodated. As previously excluded groups begin to participate in the scientific enterprise in numbers and at levels significant enough to be felt, the scientific enterprise may need to become more flexible in the lifestyles it allows and the judgments it passes upon the value of different kinds of knowledge and the people who seek it. A healthy science cannot afford to do less if its goal is to discover truth, rather than one face of it; and to solve human problems, not just intellectually interesting ones.

APPENDIX I

EVALUATION OF THE WORKSHOP

Participants were asked to fill out an evaluation sheet as a guide to the meeting arrangers for any future workshops. While not all participants returned the evaluation sheet, and some answered only part of the questions asked, the results were useful. Total responses are tallied on the evaluation sheet on page 49.

Comments were varied. About one third of those responding indicated that the number of panelists or the length of their presentations left too little time for discussion with the other workshop participants. Some felt there was too much emphasis on problems of women and minorities, some wanted more "how to do" presentations on manpower planning, and a number suggested that more handouts of summaries or data from the speakers would have been helpful. In this connection, several emphasized the usefulness of the report on Supply and Demand for Scientists and Engineers that was mailed to all registrants prior to the workshop.

Almost one fourth of the speakers suggested that this kind of workshop be repeated, some emphasizing the need to do more within this subject area, some indicating that the subject should be narrowed, and some suggesting a broader scope for additional workshops.

Lively interaction between panelists and other workshop participants emphasized repeatedly the pervasiveness and the complexity of federal activities and regulations affecting every stage of the lives of scientists and engineers, from recruitment to education and training, through utilization in the scientific and engineering workforce. Not only are individuals affected directly by government activities and regulations, but their activities from early career choice through retirement are secondarily affected by government influence on society goals, educational institutions, and employers in every sector.

A period of a day and a half could not possibly have covered all these influences and their interactions. It did serve to indicate something of the scope and complexity of the interrelationships that result directly and indirectly from the activities of the government.

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PLEASE RETURN TO THE REGISTRATION TABLE AT THE END OF THE WORKSHOP, OR MAIL TO THE SCIENTIFIC MANPOWER COMMISSION, 1776 MASSACHUSETTS AVENUE, N.W., WASHINGTON, D.C. 20036.

WORKSHOP EVALUATION

	Excellent	Good	Fair	Poor
PROGRAM SUBJECT CONTENT	8	14	8	
EFFECTIVENESS OF MODERATOR				
PANEL I	6	17	6	
PANEL II	12	15	2	
PANEL III	16	11	2	
SPEAKER PRESENTATIONS				
PANEL I	5	16	7	
PANEL II	5	19	5	
PANEL III	9	15	4	1
OPPORTUNITIES FOR GROUP DISCUSSION				
PANEL I	4	18	6	1
PANEL II	1	17	6	5
PANEL III	6	15	5	3
MEETING ARRANGEMENTS	21	10		
MEETING FACILITIES	19	11	1	
OVERALL ASSESSMENT OF EFFECTIVENESS	6	20	2	

DID WORKSHOP LIVE UP TO YOUR EXPECTATIONS? _____ IF NOT, PLEASE EXPLAIN _____

YES: 21 NO: 9 YES AND NO: 2

COMMENTS:

WORKSHOP ON MANPOWER PLANNING FOR SCIENTISTS AND ENGINEERS

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APPENDIX III

GLOSSARY OF ACRONYMS

ACS - American Chemical Society
AIP - American Institute of Physics
APS - American Physical Society

BHM - Bureau of Health Manpower
BLS - Bureau of Labor Statistics

CETA - Comprehensive Education and Training Act

DOL - Department of Labor

EEO - Equal Employment Opportunity
EEOC - Equal Employment Opportunity Commission
EPA - Environmental Protection Agency
ERDA - Energy Research and Development Administration
ETA - Employment and Training Administration

FEA - Federal Energy Administration

GE - General Electric
GNP - Gross National Product

HMO - Health Maintenance Organization
HRA - Health Resources Administration

IBM - International Business Machines

MAO - Manpower Assessment Office of ERDA
MAPS - Manpower Analysis and Planning Society
MCS - Manpower Characteristics System
MDTA - Manpower Development and Training Act
MWEP - Minority Women Employment Program in DOL

NCES - National Center for Education Statistics
NIH - National Institutes of Health
NSF - National Science Foundation

OES - Occupational Employment Statistics
OMB - Office of Management and Budget
ORD - Office of Research and Development at DOL

R&D - Research and Development

SESA - State Employment Service Agency
SMC - Scientific Manpower Commission
SMSA - Standard Metropolitan Statistical Area

TDHR - Texas Department of Human Resources
TVA - Tennessee Valley Administration
TWQB - Texas Water Quality Board

OTHER PUBLICATIONS OF THE SCIENTIFIC MANPOWER COMMISSION

- *SCIENTIFIC, ENGINEERING, TECHNICAL MANPOWER COMMENTS*, periodical, 10/yr. $20.00 per year; 2 yrs., $35.00; 3 yrs., $50.00

A monthly digest of current developments affecting the recruitment, training and utilization of scientific, engineering, and technical manpower. Special sections include current information on supply and demand, women and minorities in science, education, pending legislation, federal agency activities, salaries, and new publications of interest to producers and users of technical manpower.

- *PROFESSIONAL WOMEN AND MINORITIES, A Manpower Data Resource Service*, June 1975, $40.00. Continuing update - supplement service, $25.00 per year.

This comprehensive 320-page study published in 1975 for use by educational institutions, industry and government brought together for the first time virtually all available data on manpower at professional levels with special emphasis on women and minorities in the natural and social sciences, engineering, arts, humanities, education and the professions.

Published in loose-leaf format with appropriate subject divider tabs, the four-part reference book includes basic information on affirmative action; manpower data in all fields from more than 140 sources; annotated recruitment resources; a bibliography, and a comprehensive cross incex. Approximately 400 tables and charts with breakouts by sex and/or minority status provide data on enrollments; degrees; and on general, academic and federal workforce participation of women and minorities by field and subfield. Each data resource section, arranged by field, is supplemented with textual highlights of the data and lists of specialized recruitment resources for women and minorities in that field.

A continuing subscription service updates and supplements the statistics as new data become available. 1976 supplements were published in February and October, 1976.

- *SALARIES OF SCIENTISTS, ENGINEERS AND TECHNICIANS, A Summary of Salary Surveys*, Seventh Edition, December 1975. $15.00 per copy.

A 112-page report presenting detailed information on starting and advanced salaries in industry, government and educational institutions with breakouts by field, highest degree, sex, years since first degree, age group, category of employment, work activity, type of employer, geographic area, academic rank, Civil Service grade and grade distribution, and level of responsibility, with some comparative salary data in non-technical fields. Includes both published and previously unpublished data on salaries for the period 1972-1975, with some trend data beginning in 1961.

The seventh edition of *SALARIES OF SCIENTISTS, ENGINEERS AND TECHNICIANS - A Summary of Salary Surveys* (December 1975, 106 +vi) includes 128 tables and 11 charts.

For comparing data back through 1971, copies of the Fifth (June 1971) and Sixth Editions (August 1973) are available, at reduced rates.

- *TEST YOURSELF FOR SCIENCE*, April 1971. Single copy, $1.00; 25 or more copies, 50¢ each.

  A novel career booklet to "test" a student's interests in various fields of science - chemistry, biology, mathematics, geology, physics - and engineering.

  This 48 page program booklet guides students as they search for their science career interest. Sources of additional information are included.

- *SCIENCE AND ENGINEERING CAREERS - A BIBLIOGRAPHY*, April 1974. Single copy, $2.00; 25 or more, $1.00 each.

  An extensive bibliography of career guidance information in science and engineering, with complete source address, cost, etc. It is designed to help young people, their parents and their guidance counselors to obtain accurate and up-to-date information about careers in science and engineering, including details on necessary training and professional employment opportunities. Sections on additional sources for obtaining career information, and a listing of sources of information on financial aid complete this comprehensive bibliography.

SUPPLY AND DEMAND FOR SCIENTISTS AND ENGINEERS - A REVIEW OF SELECTED STUDIES, by Betty M. Vetter (Scientific Manpower Commission, February 1977, 54 pp.) is a publication used as background information for this workshop. Copies are available from SMC for $1.50 each.

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